**In the United States Patent and Trademark Office
on Appeal from the Examiner to the Board
of Patent Appeals and Interferences**

In re Application of:	Shmuel Shaffer
Serial No.:	10/824,180
Filing Date:	April 14, 2004
Group Art Unit:	2614
Confirmation No.:	6361
Examiner:	Khai N. Nguyen
Title:	***Enhanced Extension Mobility***

Mail Stop: Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Appeal Brief

Appellants have appealed to the Board of Patent Appeals and Interferences ("Board") from the decision of the Examiner mailed April 29, 2010, finally rejecting Claims 1-45. Appellants filed a Notice of Appeal on July 29, 2010, along with a Pre-Appeal Brief Request for Review. A Notice of Panel Decision from Pre-Appeal Brief Request for Review was mailed September 27, 2010, indicating that the case should proceed to the Board. A previous Appeal Brief was filed in this case on October 6, 2008, and the then-statutory fee of $510.00 was paid with the filing of that previous Appeal Brief. Since no final Board decision was reached after the filing of the previous Appeal Brief, only the $30.00 difference between the current statutory fee of $540.00 and the previously-paid $510.00 fee is believed to be due for this Appeal Brief. *See* M.P.E.P. § 1204.01.

Real Party In Interest

This Application is currently owned by Cisco Technology, Inc. as indicated by an assignment recorded on April 14, 2004, in the Assignment Records of the United States Patent and Trademark Office (PTO) at Reel 015243, Frame 0325 (5 pages).

Related Appeals and Interferences

To the knowledge of Appellants' counsel, there are no appeals, interferences, or judicial proceedings that are related to or will directly affect, be directly affected by, or have a bearing on the Board's decision regarding this Appeal.

Status of Claims

Claims 1-45 are pending in this Application[1] and stand rejected pursuant to the Final Office Action mailed April 29, 2010 (the "Final Office Action") for the following reasons:

- Claims 1-8, 10-20, 22-34, and 36-42 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. 2005/0180555 by Sarp et al. ("*Sarp*");
- Claims 9, 21, and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Sarp* in view U.S. Patent 5,933,488 to Marcus et al. ("*Marcus*"); and
- Claims 43-45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Sarp* in view U.S. Patent 6,292,792 to Baffes et al. ("*Baffes*")

Claims 1-45 are presented for Appeal. All pending claims are shown in Appendix A.

[1] In the Final Office Action, the Examiner objected to Claims 7, 19, 33, and 42 for including a typographical error. To simplify issues for Appeal, Appellants submitted an Amendment pursuant to 37 C.F.R. §41.33(a) amending Claims 7, 19, 33, and 42 to correct the identified typographical error. In this Appeal Brief, Appellants treat these amendments as having been entered.

Status of Amendments

On October 22, 2010, Appellants submitted an Amendment pursuant to 37 C.F.R. §41.33(a) amending Claims 7, 19, 33, and 42 to correct typographical errors identified by the Examiner in the Final Office Action. These amendments simplify issues for Appeal and do not affect the scope of any other pending claim on Appeal. Accordingly, Appellants treat this Amendment as having been entered for purposes of this Appeal. All other amendments submitted by Appellants were entered by the Examiner prior to the mailing of the Final Office Action.

Summary of Claimed Subject Matter

In certain embodiments, the present invention is operable to provide enhanced extension mobility (EEM) in a communication network. FIGURE 1 illustrates one embodiment of a communication system 10 operable to provide EEM in a communication network 12. Communication networks 12a and 12b are local area networks (LANs). Communication network 12c is a public switched telephone network (PSTN). Communication networks 12 are coupled to each other using network links 14 that may each include one or more LANs, wide area networks (WANs), metropolitan area networks (MANs), portions of the Internet, PSTNs, or other network links 14 or a combination of two or more such network links 14. In particular embodiments, a contact admission control (CAC) system is used to monitor bandwidth availability over a WAN coupling two or more communication networks 12 to each other.

One or more portions of a communication network 12 may be associated with a particular enterprise or other organization. Another organization may operate one or more such portions of communication network 12 according to an outsourcing arrangement between the two organizations. In addition, one or more of portions of communication network 12 may include a private communication network 12, a virtual communication network 12, or both. One or more portions of communication network 12 may include one or more trust domains. One or more of portions of communication network 12 may be a distributed communication network 12.

A communication network 12 may include one or more network devices. A network device includes one or more hardware components, software components, or embedded-logic components or a combination of two or more such components supporting communication among multiple endpoints 16. As an example and not by way of limitation, a network device may include one or more network components, gatekeepers, contact managers, routers, hubs, switches, gateways, or endpoints 16 or a combination of two or more such devices. In particular embodiments, a network device may be an automatic contact distributor (ACD) coupled to one or more endpoints 16. An ACD includes a specialized communication system for routing incoming contacts to available agents at endpoints 16 coupled to the ACD. The ACD may route incoming contacts so that they are properly distributed among available agents. A contact includes a request for service communicated using any audio and/or video means, including signals, data or messages transmitted through voice devices, text chat, web sessions, facsimile, instant messaging and e-mail. Network devices in a communication

network 12 may be coupled to each other according to any suitable arrangement using one or more network segments. A network segment may include one or more communication networks 12, computer buses, wireline segments, optical segments, wireless segments, or other segments or a combination of two or more of such segments.

Communication networks 12 each have endpoints 16. An endpoint 16 includes one or more hardware components, software components, or embedded-logic components or a combination of two or more such components for communicating with one or more other endpoints 16. As an example and not by way of limitation, an endpoint 16 may include a phone (which may be a mobile phone, a desktop phone, or another phone), a computer (which may be a laptop computer, a desktop computer, or other computer), a personal digital assistant (PDA), a video monitor, a camera, a fax machine, or other device. An endpoint 16 may be coupled to a network device in a communication network 12 using one or more endpoint links 18 that may each include one or more computer buses, LANs, MANs, WANs, or portions of the Internet or any other appropriate wireline, optical, wireless, or other endpoint links 18. Endpoints 16 may communicate with each other using packets of data. A packet may include one or more packets, cells, frames, or other units of data. Data may include one or more data components, metadata components, executable software components, or other components.

Endpoints 16 may use one or more suitable communication protocols to communicate with each other. According to one or more such communication protocols, one or more endpoints 16 may each be identified using a unique address. In addition or as an alternative, one or more network devices may each be identified using a unique address. As an example and not by way of limitation, in particular embodiments, two or more endpoints 16 may each be identified by an Internet Protocol (IP) address and may communicate with each other using IP. In these embodiments, one or more components of system 10 may support point-to-point, multicast, unicast, or other communication. One or more endpoints 16 and network devices may support Voice over IP (VoIP) or Voice over Packet (VoP). To communicate using VoIP or VoP, an endpoint packetizes voice data into packets communicable over one or more packet-based communication networks 12. Endpoints 16 and network devices that may support VoIP or VoP include telephones, fax machines, computers running telephony software, nodes, gateways, and other devices capable of providing telephony functionality over a packet-based communication network 12.

Communication between a first endpoint 16 and one or more second endpoints 16 may include one or more voice components, text components, executable software components, data components, or other components or a combination of two or more such components. As an example and not by way of limitation, a communication between a first endpoint 16 and one or more second endpoints 16 may include one or more instant messages (IMs). One or more endpoints 16 and network devices may support use of Session Initiation Protocol (SIP) for IM and possibly other functionality. In addition or as an alternative, one or more endpoints 16 and network devices may support use of SIP for Instant Messaging and Presence-Leveraging Extensions (SIMPLE) Protocol. In system 10, one or more voice-enabled endpoints 16 may support use of SIP and presence-related applications. In addition or as a further alternative, one or more endpoints 16 and network devices may support use of Instant Messaging and Presence Protocol (IMPP). Reference to "IM" may encompass both IM and one or more IM-related protocols.

A communication network 12 may receive incoming phone calls from first endpoints 16 and route the incoming phone calls to second endpoints 16 coupled to communication network 12. Communication network 12 may route incoming phone calls according to calling phone numbers, called phone numbers, or both. An endpoint 16 may support an extension of a user. In particular embodiments, an extension includes a number or a series of numbers corresponding to a first user. One or more second users may use the extension to contact the first user. Communication network 12 may provide extension mobility or similar functionality enabling "hotelling" or a similar feature. Such functionality may allow a user to logon at a first endpoint 16 so that first endpoint 16 supports an extension of the first user and then log off at first endpoint 16. The user may then logon at a second endpoint 16 so that second endpoint 16 supports the extension of the user, which may provide mobility to the user in communication network 12. In particular embodiments, a user may be concurrently logged on at multiple endpoints 16.

Communication network 12a includes an EEM server 20 and EEM data 22. EEM server 20 may interact with EEM clients 24 at endpoints 16 coupled to communication network 12a to provide EEM functionality to endpoints 16, as described below. EEM server 20 and EEM clients 24 may use EEM data 22 to provide such functionality, as described below. Although EEM server 20 is illustrated and described as providing EEM functionality to endpoints 16 coupled to communication network 12a, the present invention contemplates server 20 providing EEM functionality to any suitable endpoints 16 coupled to any suitable

communication networks 12. EEM client 24 may be either a thin (browser based) or a thick client.

An EEM client 24 at an endpoint 16 includes one or more hardware components, software components, or embedded logic components or a combination of two or more such components providing EEM functionality at endpoint 16, as described below. An endpoint 16 including an EEM client 24 may have a private mode and a shared mode. In private mode, endpoint 16 supports only one extension. In shared mode, endpoint 16 concurrently supports multiple extensions. An endpoint 16 may receive an incoming phone call that has a called extension corresponding to an extension supported at endpoint 16 and, in response to receiving the incoming phone call, prompt a called user of the incoming phone call to answer the incoming phone call. In particular embodiments, in private mode, endpoint 16 may receive the incoming phone call only if the called extension corresponds to the one extension supported at endpoint 16. Because endpoint 16 supports only one extension in private mode, endpoint 16 need not (but may nonetheless) identify the called extension when endpoint 16 prompts the called user to answer the incoming phone call. In particular embodiments, in shared mode, endpoint 16 may receive the incoming phone call if the called extension corresponds to any one of the multiple extensions supported at endpoint 16.

Because endpoint 16 supports multiple extensions in shared mode, endpoint 16 may identify the called extension when endpoint 16 prompts the called user to answer the incoming phone call. As an example and not by way of limitation, endpoint 16 may display the called extension, a name of the called user, or both at a display screen of endpoint 16. As another example, endpoint 16 may audibly announce a name of the called user between rings. In particular embodiments, endpoint 16 may access a .wav or similar file to audibly announce a name of a user. The .wav or similar file may be stored in a field (such as a UserName field) in a directory in EEM data 22 and downloaded to endpoint 16 when the user logs on at endpoint 16. As another example, endpoint 16 may play a unique ring tone that identifies the called user. In particular embodiments, when a user logs on at endpoint 16, endpoint 16 may present a unique ring tone to the user so that the user will later be able to identify incoming phone calls for the user. In particular embodiments, the user may select the unique ring tone at logon.

When an outgoing phone call is placed from an endpoint 16, endpoint 16 may generate signaling data identifying a calling extension of the outgoing phone call, a calling user of the outgoing phone call, or both for communication with the outgoing phone call. In

particular embodiments, in private mode, endpoint 16 may generate the signaling data according to the one extension supported at endpoint 16. In particular embodiments, in shared mode, endpoint 16 may generate the signaling data according to user input specifically identifying the calling extension. As an example and not by way of limitation, when the outgoing phone call is placed, the calling user may press a button at endpoint 16 specifically identifying the calling user. As another example, when the outgoing phone call is placed, endpoint 16 may prompt the calling user to identify the calling user. To prompt the calling user to identify the calling user, endpoint 16 may audibly announce the following menu options: "Press 1 if you are Joe. Press 2 if you are Mark." The calling user may then select the menu option corresponding to the calling user to identify the calling user. In particular embodiments, when endpoint 16 receives user input identifying the calling user, endpoint 16 may present a dial tone for placing the outgoing phone call. In particular embodiments, in private mode, endpoint 16 may generate the signaling data according to a predetermined extension. As an example and not by way of limitation, endpoint 16 may be configured so that, in shared mode, endpoint 16 generates signaling data for every outgoing phone call placed at endpoint 16 according to an extension of an owner of endpoint 16. Endpoint 16 may be located in an office of the owner of endpoint 16.

An endpoint 16 may assume one or more preferences of a user whose extension is supported at endpoint 16. To assume a preference of a user, endpoint 16 may download the preference from a profile of the user in EEM data 22 when the user logs on at endpoint 16. In particular embodiments, in private mode, endpoint 16 may assume all preferences of the one user whose extension is supported at endpoint 16. In particular embodiments, in shared mode, endpoint 16 may assume one or more preferences of one or more of the multiple users whose extensions are supported at endpoint 16. When endpoint 16 receives an incoming phone call that has a called extension corresponding to an extension of a user supported at endpoint 16, endpoint 16 may exhibit one or more preferences of that user with respect to the incoming phone call. Similarly, when a user whose extension is supported at endpoint 16 places an outgoing phone call, endpoint 16 may exhibit one or more preferences of that user with respect to the outgoing phone call. In particular embodiments, in shared mode, endpoint 16 may assume one or more preferences of only one user whose extension is supported at endpoint 16. Endpoint 16 may be configured so that, in shared mode, endpoint 16 assumes all preferences of an owner of endpoint 16 and no preferences of any other user. In particular embodiments, when a user whose extension is supported at endpoint 16 places an outgoing

phone call, call detail records (CDRs) and billing information may be updated to indicate that the user made the outgoing phone call. The CDRs and billing information may be stored at EEM data 22 or elsewhere, according to particular needs.

To access EEM functionality at an endpoint 16, a user may invoke an EEM client 24 at endpoint 16. When the user invokes EEM client 24, EEM client 24 may cause endpoint 16 to provide a logon menu to the user. In particular embodiments, endpoint 16 displays the logon menu at a display screen of endpoint 16. The logon menu may prompt the user to identify the user, provide a valid password, or both to logon at endpoint 16. In particular embodiments, the logon menu prompts the user to enter an extension of the user and a password corresponding to that extension. If the user enters a valid extension and a valid password corresponding to that extension, EEM client 24 may cause endpoint 16 to provide the following menu option to the user: "Enter 1 to logon in private mode. Enter 2 to logon in shared mode." If the user selects private mode, EEM client 24 may configure endpoint 16 to support only the extension entered by the user, as described above. If the user selects shared mode, EEM client 24 may configure endpoint 16 to support the extension entered by the user in addition to one or more other extensions already supported at endpoint 16, as described above. To configure endpoint 16 to support the extension entered by the user, EEM client 24 may establish one or more new lines or other connections at endpoint 16 for the extension entered by the user. EEM client 24 may communicate with EEM server 20 to establish the one or more new lines or other connections at endpoint 16. In addition, EEM client 24 may communicate with EEM server 20 to access EEM data 22, as described above.

FIGURE 2 illustrates an example method for EEM. The method begins at step 100, where a user invokes an EEM client 24 at an endpoint 16. At step 102, endpoint 16 prompts the user to enter an extension and a password. At step 104, the user enters an extension and a password. At step 106, endpoint 16 determines whether the extension and the password are valid. If the extension or the password is invalid, the method returns to step 102. If the extension and the password are valid, the method proceeds to step 108, where endpoint 16 prompts the user to select private mode or shared mode. At step 110, the user selects private mode or shared mode. At step 112, endpoint 16 determines whether the user selected private mode. If the user selected private mode, the method proceeds to step 114. At step 114, EEM client 24 configures endpoint 16 to support only the extension entered by the user at step 104, at which point the method ends. Returning to step 112, if the user did not select private mode, the method proceeds to step 116. At step 116, endpoint 16 determines whether the

user selected shared mode. If the user selected shared mode, the method proceeds to step 118, where EEM client 24 configures endpoint 16 to support the extension entered by the user at step 104 in addition to one or more other extensions of one or more other users already supported at endpoint 16, at which point the method ends. Returning to step 116, if the user did not select shared mode, the method returns to step 108.

With regard to the independent claims currently under Appeal, Appellants provide the following concise explanation of the subject matter recited in the claim elements. For brevity, Appellants do not necessarily identify every portion of the Specification and drawings relevant to the recited claim elements. Additionally, this explanation should not be used to limit Appellants' claims but is intended to assist the Board in considering the Appeal of this Application.

For example, independent Claim 1 recites the following:

> A system for enhanced extension mobility (*see, e.g.,* Fig. 1; Spec. at 3:4; and 6:2-10:22), the system comprising one or more processing units collectively operable to:
>
> access user input indicating–a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 3:5-11; 9:19-11:7); and
>
> in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 11:23-14:2; 14:8-29).

As another example, independent Claim 15 recites the following:

> A method for enhanced extension mobility (*see, e.g.,* Fig. 2; Spec. at 3:4; and 6:2-10:22), the method comprising:
>
> accessing user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 3:5-11; 9:19-11:7); and
>
> in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configuring the endpoint to concurrently support an extension of the user and one or more other

extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 11:23-14:2; 14:8-29).

As another example, independent Claim 27 recites the following:

A computer-readable medium encoded with logic for enhanced extension mobility (*see, e.g.,* Fig. 2; Spec. at 3:4; and 6:2-10:22), the logic when executed operable to:

access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 3:5-11; 9:19-11:7); and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 11:23-14:2; 14:8-29).

As another example, independent Claim 41 recites the following:

A system for enhanced extension mobility(*see, e.g.,* Fig. 1; Spec. at 3:4; and 6:2-10:22), the system comprising:

means for accessing user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 3:5-11; 9:19-11:7); and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, means for configuring the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 11:23-14:2; 14:8-29).

As another example, independent Claim 42 recites the following:

A system for enhanced extension mobility (*see, e.g.,* Fig. 1; Spec. at 3:4; and 6:2-10:22), the system comprising one or more processing units located at an endpoint and collectively operable to:

access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 3:5-11; 9:19-11:7);

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users (*see, e.g.,* Fig. 2; Spec. at 11:23-14:2; 14:8-29);

in response to an incoming phone call for the user received at the endpoint, indicate the extension of the user (*see, e.g.,* Spec at 10:24-11:23);

in response to a request from the user to place an outgoing phone call from the endpoint:

prompt the user to enter the extension of the user prior to placing an outgoing phone call from the endpoint (*see, e.g.,* Spec. at 11:24-12:16); and

generate signaling data for communication with the outgoing phone call that identifies the entered extension of the user (*see, e.g.,* Spec. at 11:24-12:16).

Grounds of Rejection to be Reviewed on Appeal

1. Are Claims 1-8, 10-20, 22-34, and 36-42 properly rejected under 35 U.S.C. § 102(e) as being anticipated by *Sarp?*

2. Are Claims 9, 21, and 35 properly rejected under 35 U.S.C. § 103(a) as being unpatentable over the proposed *Sarp* in view of *Marcus*?

3. Are Claims 43-45 properly re rejected under 35 U.S.C. § 103(a) as being unpatentable over the proposed *Sarp* in view of *Baffes*?

Argument

For at least the following reasons, Appellants respectfully submit that the Examiner's rejections of Claims 1-45 are improper and should be reversed by the Board.

I. The Rejections of Claims 1-8, 10-20, 22-34, and 36-42 under 35 U.S.C. § 102(e) are Improper

A. Overview

Claims 1-8, 10-20, 22-34, and 36-42 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Sarp*. A copy of *Sarp* is attached as Tab 1 of Appendix B. Appellants respectfully submit that these rejections are improper and should be reversed by the Board.

B. Legal Standard for Demonstrating Anticipation

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added); M.P.E.P. ch. 2131. "The **identical invention** must be shown in as **complete detail as contained** in the . . . claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989) (emphasis added); *see also* M.P.E.P. ch. 2131. In addition, "[t]he elements must be arranged as required by the claim." *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989); *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990); M.P.E.P. ch. 2131.

The Federal Circuit recently clarified this standard in *Net Moneyin, Inc. v. Verisign, Inc.*, 545 F.3d 1359, 88 U.S.P.Q.2d 1751 (Fed. Cir. 2008). In *Net Moneyin*, the Federal Circuit held that a finding of anticipation under 35 U.S.C. § 102 is proper only when a "reference discloses within the four corners of the document not only all of the limitations claimed but also **all of the limitations arranged or combined in the same way** as recited in the claim." *Net Moneyin*, 545 F.3d at 1371, 88 U.S.P.Q.2d at 1759 (emphasis added). The prior art reference must "**clearly and unequivocally** disclose the claimed invention ... **without any need for picking, choosing, and combining various disclosures not directly related to each other by** the teachings of the cited reference." *Net Moneyin*, 545 F.3d at 1371, 88 U.S.P.Q.2d at 1760 (emphasis added, internal typographical notations omitted).

C. Argument

1. Independent Claims 1, 15, 27, and 41-42

Claim 1, which Appellants discuss as an example, recites the following:

> A system for enhanced extension mobility, the system comprising one or more processing units collectively operable to:
>
> access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users; and
>
> in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users.

At least because *Sarp* fails to disclose "each and every element as set forth in [Claim 1]," the rejection of Claim 1 is improper and should be reversed by the Board. *Verdegaal Bros.*, 2 U.S.P.Q.2d at 1053; M.P.E.P. ch. 2131; *see also Net Moneyin,*, 545 F.3d at 88.

As just one example, *Sarp* fails to disclose, teach, or suggest an endpoint capable of supporting a "shared mode according to which the endpoint **concurrently supports** an extension of the user and one or more other extensions of one or more other user," as recited in Claim 1. In other words, *Sarp* fails to disclose that a single endpoint can support extensions of **multiple users at the same time** (as recited in Claim 1). Rather, *Sarp*, at best, merely discloses a system in which an endpoint may support the extension of **only one** of a number of users at a time (as discussed in further detail below).

The cited portions of *Sarp* disclose a "dynamic telephone configuration" system. *Sarp* at ¶ 7. In a first disclosed embodiment, each of a number of users has a virtual extension associated with physical phone features. *Id.* at ¶ 29. When a user inputs his virtual extension and password into a telephone, the physical port of that telephone is associated with the input virtual extension such that configuration information (i.e., the physical phone features associated with the virtual extension) may be delivered over the physical port and the telephone dynamically configured to support the user. *Id.* at ¶¶ 38-40. In a second disclosed embodiment, each of a number of users has a physical extension rather than a virtual extension. *Id.* at ¶ 49. When a user inputs his physical extension and password into a

telephone, the physical extension of that telephone is swapped with the physical extension input by the user such that configuration information (i.e., the physical phone features associated with the physical extension) associated with the input physical extension may be provided to the dynamically configured telephone. *Id.* at ¶¶ 51-60.

In each of the disclosed embodiments, *Sarp*, at best, only discloses a system in which each of a number of telephones may be configured to support **a single user at a time** (i.e., the user who has entered his virtual/physical extension). *Sarp*, however, does not to disclose, teach, or suggest that any of the telephones may support multiple different users at the same time, as would be necessary for *Sarp* to even possibly disclose a "shared mode according to which the endpoint **concurrently supports** an extension of the user and one or more other extensions of one or more other user," as recited in Claim 1. Therefore, *Sarp* necessarily fails to disclose, teach, or suggest "access[ing] user input indicating a desire of the user to logon at the endpoint in a **shared mode** according to which the endpoint **concurrently supports** an extension of the user and one or more other extensions of one or more other users" and actually "configur[ing] the endpoint to **concurrently support** an extension of the user and one or more other extensions of one or more other users," as recited in Claim 1.

For at least these reasons, Appellants respectfully submit that the rejections of independent Claim 1 and its dependent claims are improper and should be reversed by the Board. For at least certain analogous reasons, Appellants respectfully submit that the rejection of independent Claims 15, 27, and 41-42 and their dependent claims are improper and should be reversed by the Board.

2. Dependent Claims 4, 16, and 30

Dependent Claims 4, 16, and 30 depend from independent Claims 1, 15, and 27, respectively, which Appellants have shown above to be allowable over *Sarp*. Thus, dependent Claims 4, 16, and 30 are allowable at least because they depend from allowable independent claims. Additionally, dependent Claims 4, 16, and 30 recite further patentable distinctions over *Sarp*.

Dependent Claim 4, which Appellants discuss as an example, recites the following:

> The system of Claim 1, wherein the one or more processing units are operable to:
>
> prompt the user to select between a private mode and the shared mode at the endpoint; and
>
> receive a selection by the user of shared mode at the endpoint, the selection providing the accessed user input.

As allegedly disclosing these limitations, the Examiner cites paragraphs 38 and 53-54 of *Sarp*, apparently asserting that *Sarp* discloses prompting a user to select between entering a physical extension (i.e., the claimed "private mode," according to the Examiner) and a virtual extension (i.e., the claimed "shared mode," according to the Examiner). *Final Office Action* at 4.

As discussed above with regard to Claim 1, the cited portion of *Sarp* merely discloses alternative embodiments (with virtual extensions being used in one embodiment and physical extensions being used in the other) according to which a telephone may be configured to support a single user. First, because *Sarp* discloses the use of virtual and physical extensions as alternative embodiments, *Sarp* necessarily fails to disclose prompting the user to select between entering a virtual extension and a physical extension. Second, because neither embodiment disclosed in *Sarp* discloses a "shared mode" (for at least the reasons discussed above with regard to Claim 1), *Sarp* is incapable of disclosing that a user is prompted to select a shared mode regardless of what other selection option may be presented to the user. Therefore, *Sarp* fails to disclose, teach, or suggest "prompt[ing] the user to select between a private mode and the shared mode at the endpoint," as recited in Claim 4.

For at least these reasons, Appellants respectfully submit that the rejection of dependent Claims 4 is improper and should be reversed by the Board. For at least certain analogous reasons, Appellants respectfully submit that the rejection of dependent Claims 16 and 30 are improper and should be reversed by the Board.

II. The Rejection of Claims 9, 21, and 35 under 35 U.S.C. §103(a) is Improper

Claims 9, 21, and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Sarp* in view of *Marcus*. A copy of *Marcus* is attached as Tab 2 of Appendix B.

Appellants respectfully submit that these rejections are improper and should be reversed by the Board.

Claims 9, 21, and 35 depend from independent Claims 1, 15 and 27, respectively, which Appellants have shown above to be allowable over *Sarp*. The Examiner does not allege that *Marcus* makes up for the above-discussed deficiencies of *Sarp*. Thus, dependent Claims 9, 21, and 35 are allowable at least because they depend from allowable independent claims. Additionally, dependent Claims 9, 21, and 35 recite further patentable distinctions over the proposed *Sarp-Marcus* combination. To avoid burdening the record and in view of the clear allowability of independent Claims 1, 15 and 27, Appellants do not specifically discuss these distinctions in this Response. However, Appellants reserve the right to discuss these distinctions in a future Response or on a future Appeal, if appropriate. Moreover, Appellants do not admit that the proposed *Sarp-Marcus* combination is possible or that the Examiner has provided an adequate reason for combining or modifying the references in the manner proposed by the Examiner.

For at least these reasons, Appellants respectfully submit that the rejection of dependent Claims 9, 21, and 35 are improper and should be reversed by the Board.

III. The Rejection of Claims 43-45 under 35 U.S.C. §103(a) is Improper

Claims 43-45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Sarp* in view of *Baffes*. A copy of *Baffes* is attached as Tab 3 of Appendix B. Appellants respectfully submit that these rejections are improper and should be reversed by the Board.

Claims 43-45 depend from independent Claims 1, 15 and 27, respectively, which Appellants have shown above to be allowable over *Sarp*. The Examiner does not allege that *Baffes* makes up for the above-discussed deficiencies of *Sarp*. Thus, dependent Claims 43-45 are allowable at least because they depend from allowable independent claims. Additionally, dependent Claims 43-45 recite further patentable distinctions over the proposed *Sarp-Baffes* combination. To avoid burdening the record and in view of the clear allowability of independent Claims 1, 15 and 27, Appellants do not specifically discuss these distinctions in this Response. However, Appellants reserve the right to discuss these distinctions in a future Response or on a future Appeal, if appropriate. Moreover, Appellants do not admit that the

proposed *Sarp-Baffes* combination is possible or that the Examiner has provided an adequate reason for combining or modifying the references in the manner proposed by the Examiner.

For at least these reasons, Appellants respectfully submit that the rejection of dependent Claims 43-45 are improper and should be reversed by the Board.

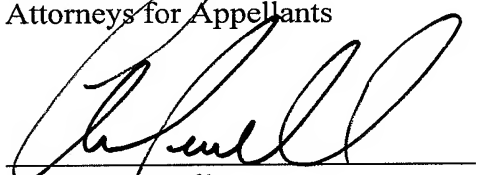
Conclusion

Appellants have demonstrated that, for at least the foregoing reasons, the present invention, as claimed, is clearly patentable over the references cited by the Examiner. Therefore, Appellants respectfully request the Board to reverse the final rejection of the Examiner and instruct the Examiner to issue a Notice of Allowance of all pending claims.

The Commissioner is hereby authorized to charge the amount of $30.00 for filing this Appeal Brief (the difference between the $510.00 statutory fee paid in connection with the filing of a previous Appeal Brief in a previous Appeal, for which no final Board decision was reached, and the current statutory fee of $540.00 - *See* M.P.E.P. § 1204.01) to Deposit Account No. 02-0384 of Baker Botts L.L.P. Although no other fees are believed to be due at this time, the Commissioner is hereby authorized to charge any necessary additional fees and credit any overpayments to Deposit Account No. 02-0384 of Baker Botts L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Appellants



Chad D. Terrell
Reg. No. 52,279

Date: October 27, 2010

Customer Number: **05073**

Appendix A: The Claims

1. A system for enhanced extension mobility, the system comprising one or more processing units collectively operable to:

access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users; and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users.

2. The system of Claim 1, wherein one or more of the processing units are located at the endpoint.

3. The system of Claim 1, wherein one or more of the processing units are located at a server remote from the endpoint.

4. The system of Claim 1, wherein the one or more processing units are operable to:

prompt the user to select between a private mode and the shared mode at the endpoint; and

receive a selection by the user of shared mode at the endpoint, the selection providing the accessed user input.

5. The system of Claim 1, wherein the one or more processing units are operable to:

prompt the user to enter an extension of the user to logon at the endpoint;

access an extension entered by the user; and

configure the endpoint to support the entered extension.

6. The system of Claim 5, wherein the one or more processing units are operable to:

prompt the user to enter a password to logon at the endpoint;

access a password entered by the user;

determine whether the entered password is valid; and

if the entered password is valid, configure the endpoint to support the entered extension.

7. The system of Claim 1, wherein the one or more processing units are further operable, in response to an incoming phone call for the user received at the endpoint, to indicate the extension of the user.

8. The system of Claim 7, wherein the one or more processing units are operable to display the extension of the user at a display screen of the endpoint to indicate the phone call for the user.

9. The system of Claim 7, wherein the one or more processing units are operable to audibly announce a name of the user to indicate the phone call for the user.

10. The system of Claim 7, wherein the one or more processing units are operable to play a ring tone corresponding to the extension of the user to indicate the phone call for the user.

11. The system of Claim 1, wherein the one or more processing units are further operable, in response to a request from the user to place an outgoing phone call from the endpoint, to:

prompt the user to enter the extension of the user prior to placing the outgoing phone call from the endpoint; and

generate signaling data for communication with the outgoing phone call that identifies the entered extension of the user.

12. The system of Claim 1, wherein the one or more processing units are further operable to generate signaling data for communication with every outgoing phone call from the endpoint according to a predetermined extension.

13. The system of Claim 43, wherein the one or more processing units are further operable, in response to the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, to configure the endpoint according to one or more preferences of the user.

14. The system of Claim 1, wherein the one or more processing units are further operable, in response to an outgoing phone call from the endpoint, to cause one or more of one or more call detail records (CDRs) and one or more billing records to be updated to indicate a calling extension of the outgoing phone call from the endpoint.

15. A method for enhanced extension mobility, the method comprising:

accessing user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users; and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configuring the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users.

16. The method of Claim 15, comprising:

prompting the user to select between a private mode and the shared mode at the endpoint; and

receiving a selection by the user of shared mode at the endpoint, the selection providing the accessed user input.

17. The method of Claim 15, comprising:

prompting the user to enter an extension of the user to logon at the endpoint;

accessing an extension entered by the user; and

configuring the endpoint to support the entered extension.

18. The method of Claim 17, comprising:

prompting the user to enter a password to logon at the endpoint;

accessing a password entered by the user;

determining whether the entered password is valid; and

configuring the endpoint to support the entered extension only if the entered password is valid.

19. The method of Claim 15, further comprising, in response to an incoming phone call for the user received at the endpoint, indicating the extension of the user.

20. The method of Claim 19, comprising displaying the extension of the user at a display screen of the endpoint to indicate the phone call for the user.

21. The method of Claim 19, comprising audibly announcing a name of the user to indicate the phone call for the user.

22. The method of Claim 19, comprising playing a ring tone corresponding to the extension of the user to indicate the phone call for the user.

23. The method of Claim 15, wherein, in response to a request from the user to place an outgoing phone call from the endpoint, the method further comprises:

prompting the user to enter the extension of the user prior to placing an outgoing phone call from the endpoint; and

generating signaling data for communication with the outgoing phone call that identifies the entered extension of the user.

24. The method of Claim 15, comprising generating signaling data for communication with every outgoing phone call from the endpoint according to a predetermined extension.

25. The method of Claim 44, comprising, in response to the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, configuring the endpoint according to one or more preferences of the user.

26. The method of Claim 15, further comprising, in response to an outgoing phone call from the endpoint, causing one or more of one or more call detail records (CDRs) and one or more billing records to be updated to indicate a calling extension of the outgoing phone call from the endpoint.

27. A computer-readable medium encoded with logic for enhanced extension mobility, the logic when executed operable to:

access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users; and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users.

28. The computer-readable medium of Claim 27, being at least partly located at the endpoint.

29. The computer-readable medium of Claim 27, being at least partly located at a server remote from the endpoint.

30. The computer-readable medium of Claim 27, wherein the logic is operable to prompt the user to select between private mode and shared mode at the endpoint, the selection by the user providing the user input.

31. The computer-readable medium of Claim 27, wherein the logic is operable to:

prompt the user to enter an extension of the user to logon at the endpoint;

access an extension entered by the user; and

configure the endpoint to support the entered extension.

32. The computer-readable medium of Claim 31, wherein the logic is operable to:

prompt the user to enter a password to logon at the endpoint;

access a password entered by the user;

determine whether the entered password is valid; and

if the entered password is valid, configure the endpoint to support the entered extension.

33. The computer-readable medium of Claim 27, wherein the logic is further operable, in response to an incoming phone call for the user received at the endpoint, to indicate the extension of the user.

34. The computer-readable medium of Claim 33, wherein the logic is operable to display the extension of the user at a display screen of the endpoint to indicate the phone call for the user.

35. The computer-readable medium of Claim 33, wherein the logic is operable to audibly announce a name of the user to indicate the phone call for the user.

36. The computer-readable medium of Claim 33, wherein the logic is operable to play a ring tone corresponding to the extension of the user to indicate the phone call for the user.

37. The computer-readable medium of Claim 27, wherein the logic is further operable to:

prompt the user to enter the extension of the user prior to placing an outgoing phone call from the endpoint; and

generate signaling data for communication with the outgoing phone call that identifies the entered extension of the user.

38. The computer-readable medium of Claim 27, wherein the logic is further operable to generate signaling data for communication with every outgoing phone call from the endpoint according to a predetermined extension.

39. The computer-readable medium of Claim 45, wherein the logic is further operable, in response to accessing the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, to configure the endpoint according to one or more preferences of the user.

40. The computer-readable medium of Claim 27, wherein the logic is further operable, in response to an outgoing phone call from the endpoint, to cause one or more of one or more call detail records (CDRs) and one or more billing records to be updated to indicate a calling extension of the outgoing phone call from the endpoint.

41. A system for enhanced extension mobility, the system comprising:

means for accessing user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users; and

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, means for configuring the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users.

42. A system for enhanced extension mobility, the system comprising one or more processing units located at an endpoint and collectively operable to:

access user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users;

in response to the user input indicating a desire of the user to logon at the endpoint in a shared mode according to which the endpoint concurrently supports an extension of the user and one or more other extensions of one or more other users, configure the endpoint to concurrently support an extension of the user and one or more other extensions of one or more other users;

in response to an incoming phone call for the user received at the endpoint, indicate ~~a~~ the extension of the user;

in response to a request from the user to place an outgoing phone call from the endpoint:

prompt the user to enter the extension of the user prior to placing an outgoing phone call from the endpoint; and

generate signaling data for communication with the outgoing phone call that identifies the entered extension of the user.

43. The system of Claim 1, wherein the one or more processing units are operable to:

access user input indicating a desire of a user to logon at an endpoint in a private mode according to which the endpoint supports only an extension of the user, wherein the user can be concurrently logged on at multiple endpoints; and

in response to the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, configure the endpoint to support only an extension of the user.

44. The method of Claim 15, comprising:

accessing user input indicating a desire of a user to logon at an endpoint in a private mode according to which the endpoint supports only an extension of the user, wherein the user can be concurrently logged on at multiple endpoints; and

in response to the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, configuring the endpoint to support only an extension of the user.

45. The computer-readable medium of Claim 27, wherein the logic is further operable to:

access user input indicating a desire of a user to logon at an endpoint in a private mode according to which the endpoint supports only an extension of the user, wherein the user can be concurrently logged on at multiple endpoints; and

in response to the user input indicating a desire of the user to logon at the endpoint in a private mode according to which the endpoint supports only an extension of the user, configure the endpoint to support only an extension of the user.

Appendix B: Evidence Appendix

Other than the references listed below and attached as Tabs 1-2 of Appendix B, no evidence was submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132, and no other evidence was entered by the Examiner and relied upon by Appellants in the Appeal.

1. *Sarp*
2. *Marcus*
3. *Baffes*

Appendix B: Evidence Appendix

Tab 1 - *Sarp*

US 20050180555A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0180555 A1**

Sarp et al. (43) **Pub. Date: Aug. 18, 2005**

(54) **DYNAMIC TELEPHONE CONFIGURATION**

(75) Inventors: **S. Murad Sarp**, Charlottesville, VA (US); **Angel Gonzalez**, Barboursville, VA (US)

Correspondence Address:
STERNE, KESSLER, GOLDSTEIN & FOX PLLC
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005 (US)

(73) Assignee: **Comdial Corporation**, Sarasota, CA (US)

(21) Appl. No.: **10/779,671**

(22) Filed: **Feb. 18, 2004**

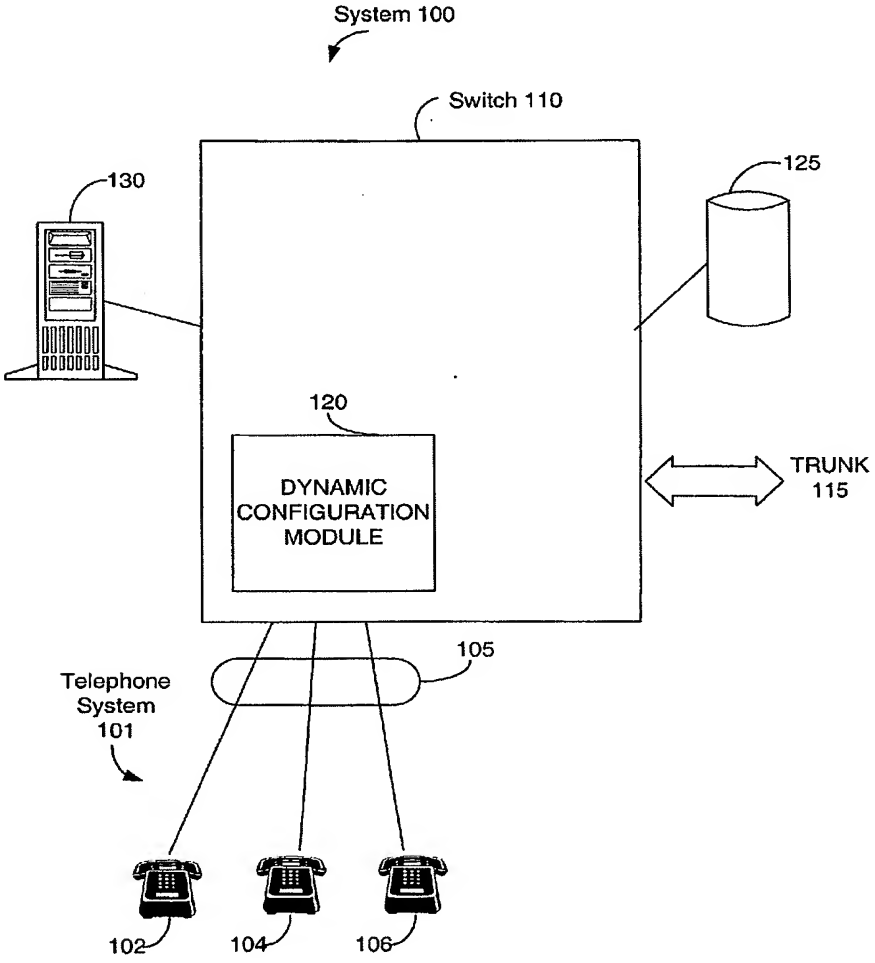
Publication Classification

(51) **Int. Cl.**[7] **H04M 3/42**; H04M 7/00

(52) **U.S. Cl.** **379/220.01**; 379/242

(57) **ABSTRACT**

The present invention provides a dynamic telephone configuration mode for users of a telephone system. In a virtual configure mode, a user inputs a virtual extension. The input virtual extension is associated with the physical extension of the telephone being dynamically configured. The DC telephone is then operated as if it were associated with the virtual extension input by the user. In the physical configure mode, a user inputs a physical extension. The input physical extension is swapped with the physical extension of the telephone being dynamically configured. The DC telephone is then operated as if it were associated with the physical extension input by the user.



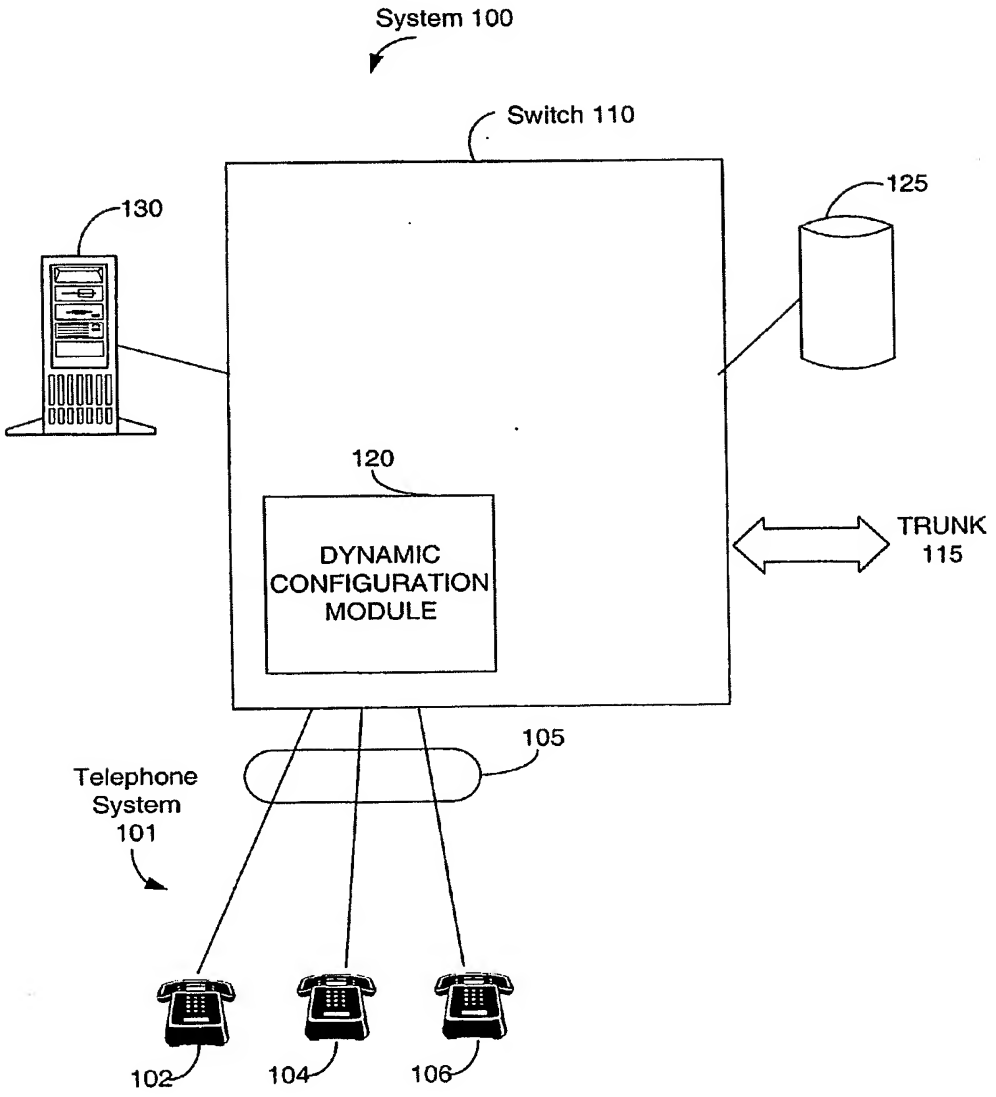

System 100
Switch 110
130
125
120
DYNAMIC CONFIGURATION MODULE
TRUNK 115
105
Telephone System 101
102
104
106

FIG. 1

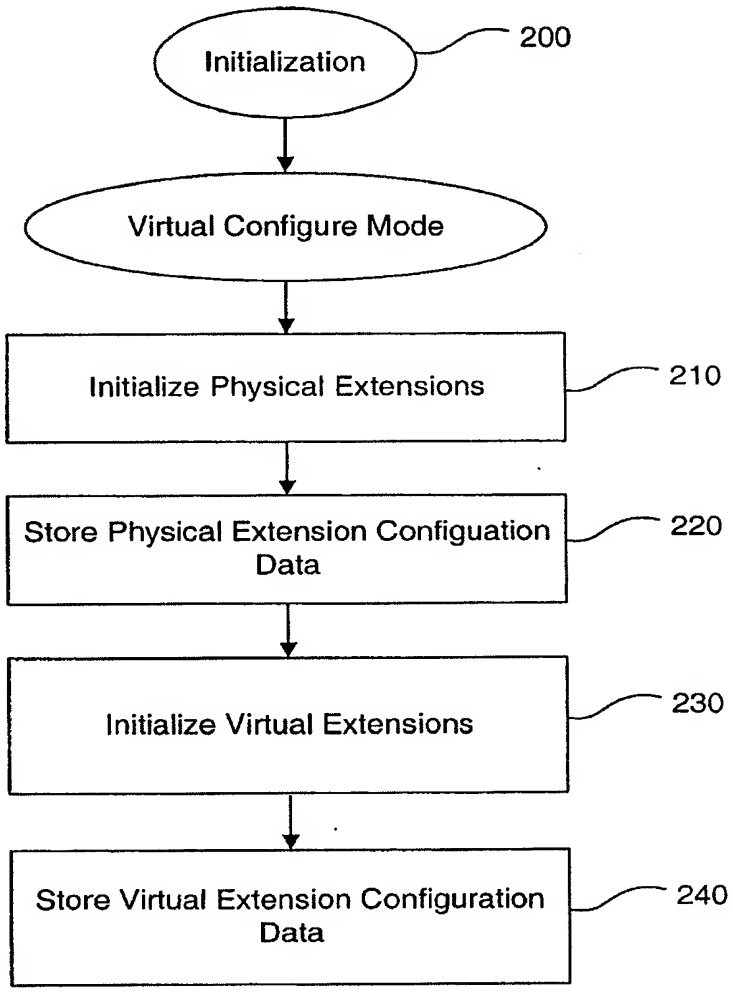

Initialization
200
Virtual Configure Mode
Initialize Physical Extensions
210
Store Physical Extension Configuation Data
220
Initialize Virtual Extensions
230
Store Virtual Extension Configuration Data
240

FIG. 2

300

Physical Extensions	Physical Ports	Physical Phone Features including button map with DC button
3002	1	
3004	2	
3006	3	

FIG. 3A

320

Virtual Extensions	User ID	Logical/Physical Mapping	Physical Phone Features including button map with DC button
3002	Jimi	3	
3004	Bob		
3006	Janis		
3008	Ben		

FIG. 3B

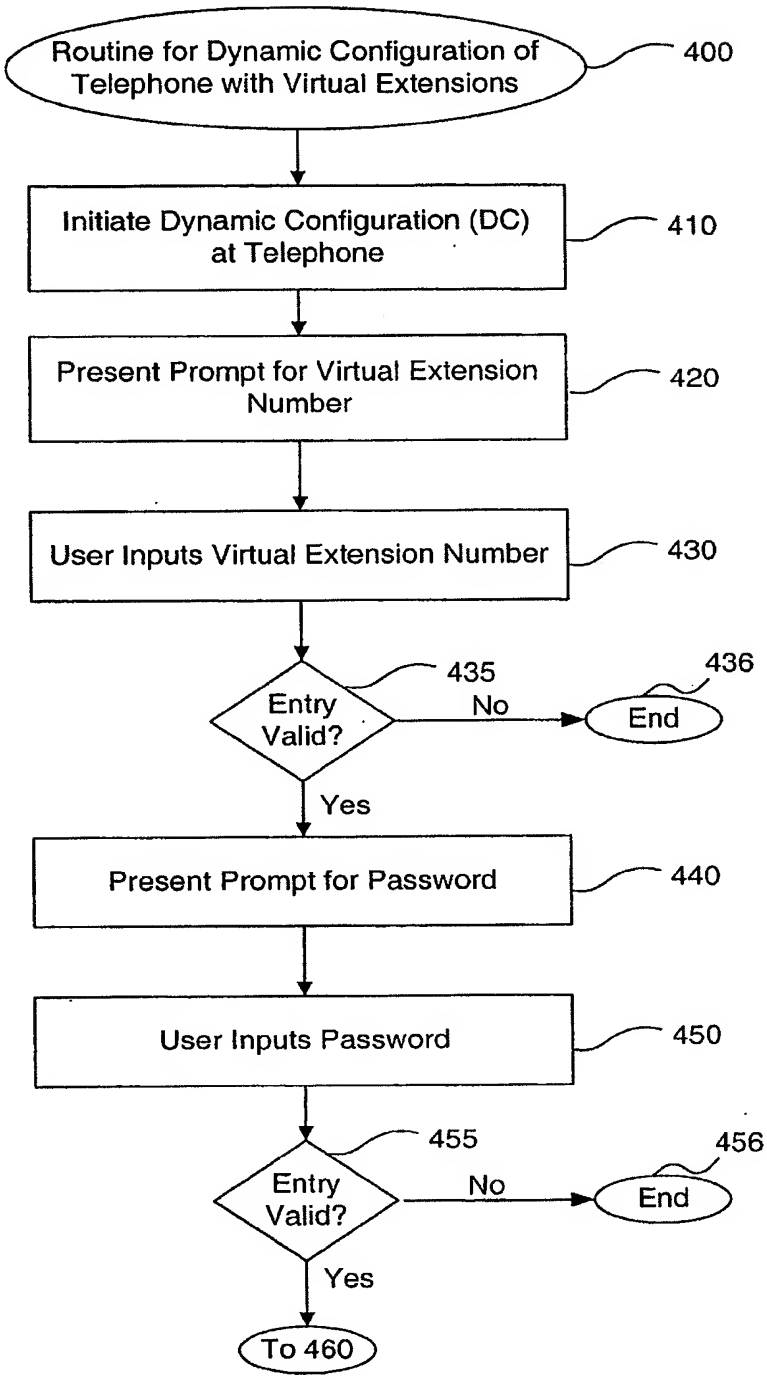

Routine for Dynamic Configuration of Telephone with Virtual Extensions
400
Initiate Dynamic Configuration (DC) at Telephone
410
Present Prompt for Virtual Extension Number
420
User Inputs Virtual Extension Number
430
Entry Valid?
435
No
436
End
Yes
Present Prompt for Password
440
User Inputs Password
450
Entry Valid?
455
No
456
End
Yes
To 460

FIG. 4A

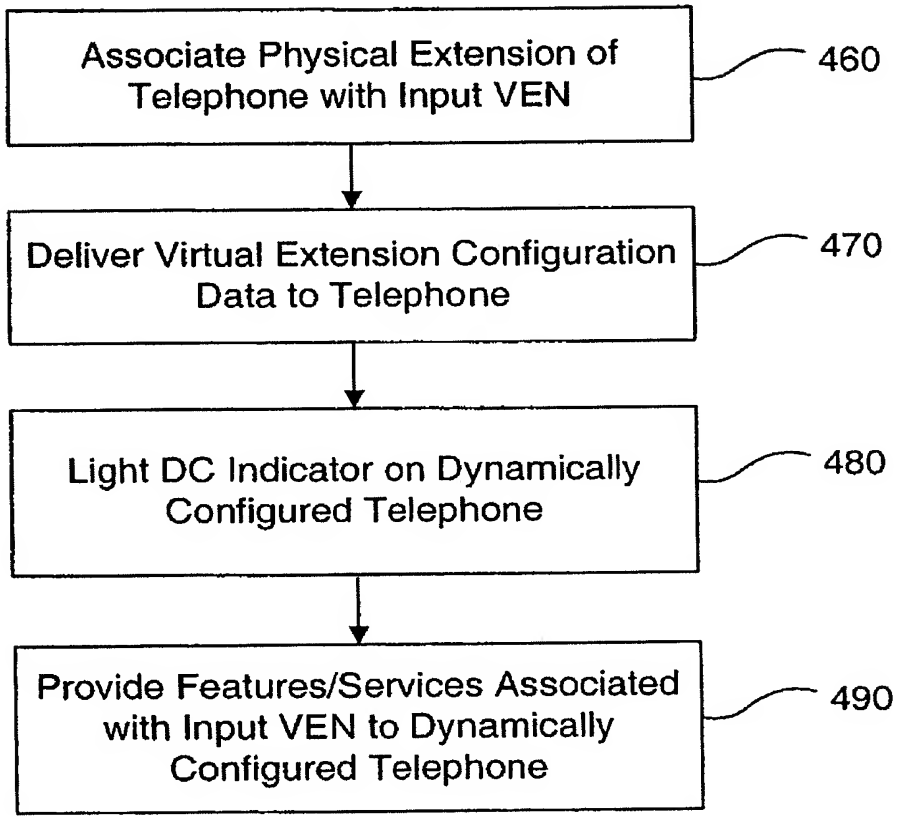

Associate Physical Extension of Telephone with Input VEN
460
Deliver Virtual Extension Configuration Data to Telephone
470
Light DC Indicator on Dynamically Configured Telephone
480
Provide Features/Services Associated with Input VEN to Dynamically Configured Telephone
490

FIG. 4B

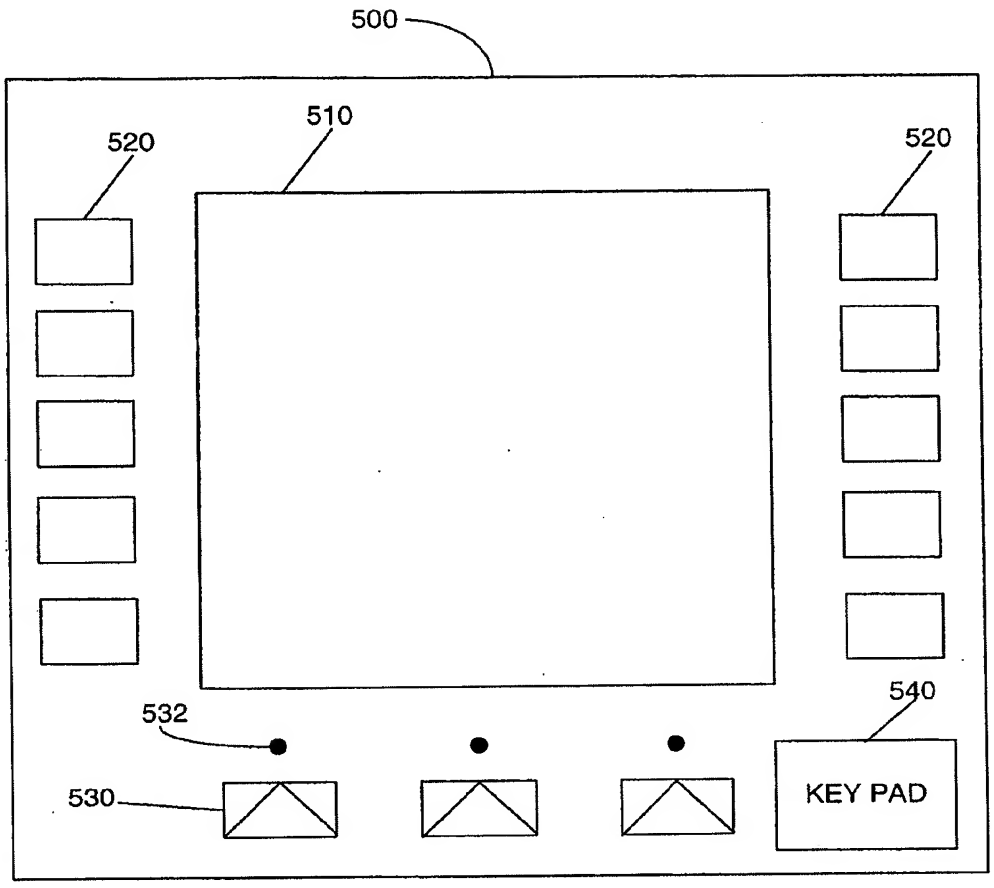


FIG. 5

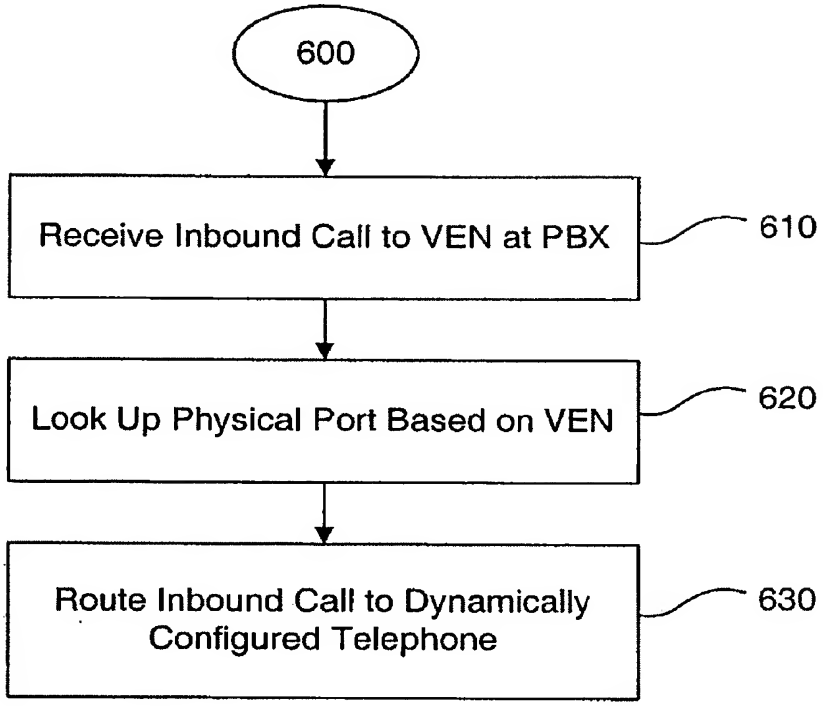

600
Receive Inbound Call to VEN at PBX
610
Look Up Physical Port Based on VEN
620
Route Inbound Call to Dynamically Configured Telephone
630

FIG. 6

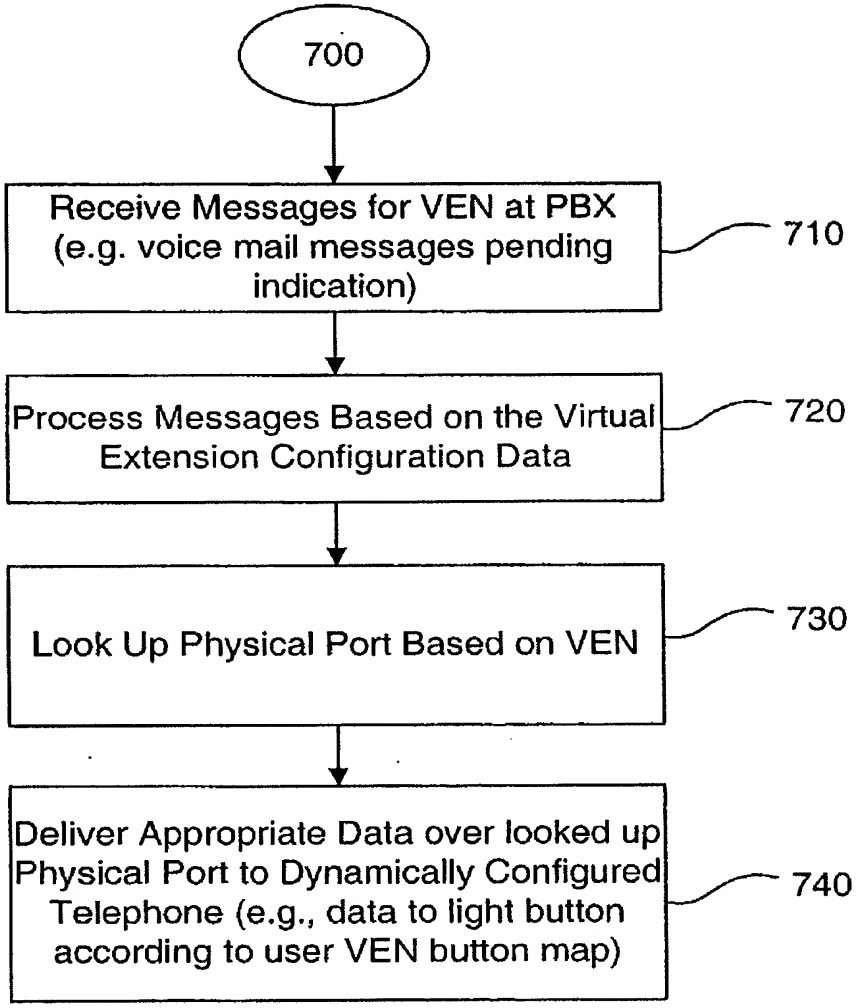

700
Receive Messages for VEN at PBX (e.g. voice mail messages pending indication)
710
Process Messages Based on the Virtual Extension Configuration Data
720
Look Up Physical Port Based on VEN
730
Deliver Appropriate Data over looked up Physical Port to Dynamically Configured Telephone (e.g., data to light button according to user VEN button map)
740

FIG. 7

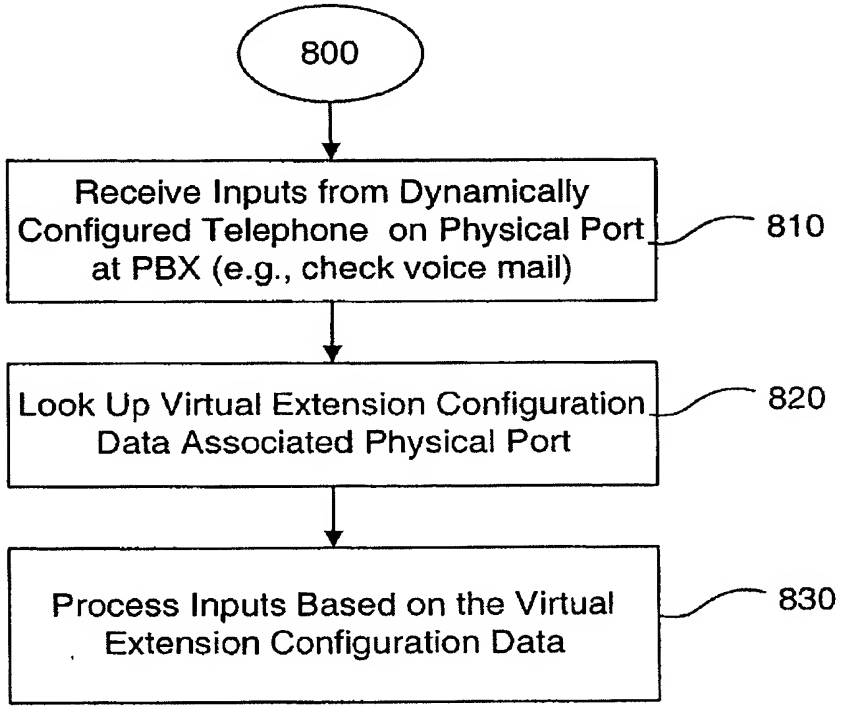

800
Receive Inputs from Dynamically Configured Telephone on Physical Port at PBX (e.g., check voice mail)
810
Look Up Virtual Extension Configuration Data Associated Physical Port
820
Process Inputs Based on the Virtual Extension Configuration Data
830

FIG. 8

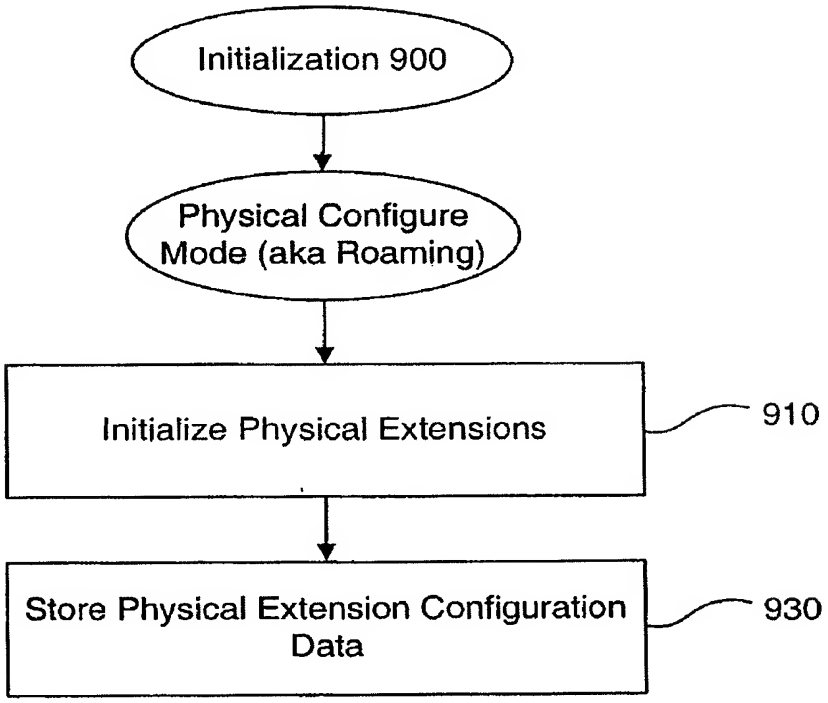
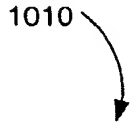

Initialization 900
Physical Configure Mode (aka Roaming)
Initialize Physical Extensions
910
Store Physical Extension Configuration Data
930

FIG. 9



Physical Extensions	Physical Ports	Physical Phone Features including button map with DC button
3002	3	
3004	2	
3006	1	

FIG. 10

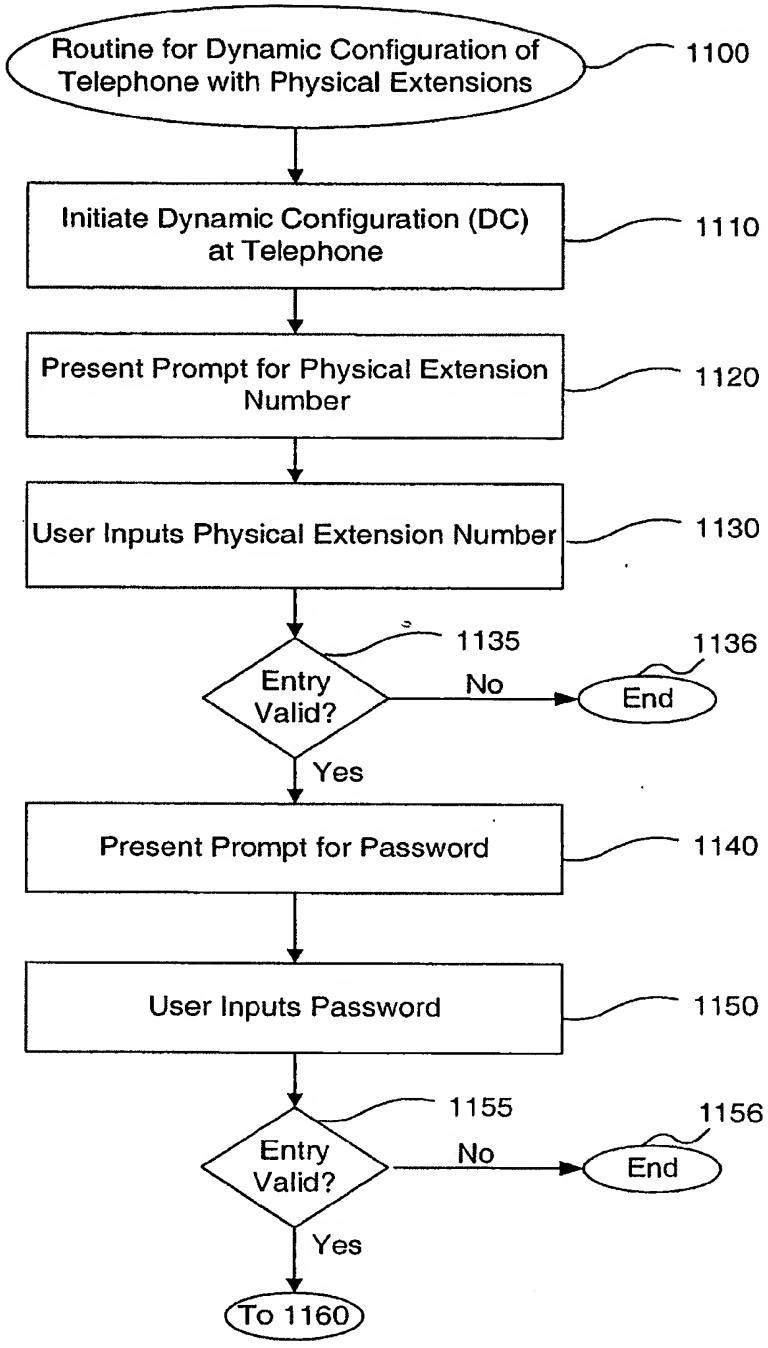

Routine for Dynamic Configuration of Telephone with Physical Extensions
1100
Initiate Dynamic Configuration (DC) at Telephone
1110
Present Prompt for Physical Extension Number
1120
User Inputs Physical Extension Number
1130
1135
Entry Valid?
No
1136
End
Yes
Present Prompt for Password
1140
User Inputs Password
1150
1155
Entry Valid?
No
1156
End
Yes
To 1160

FIG. 11A

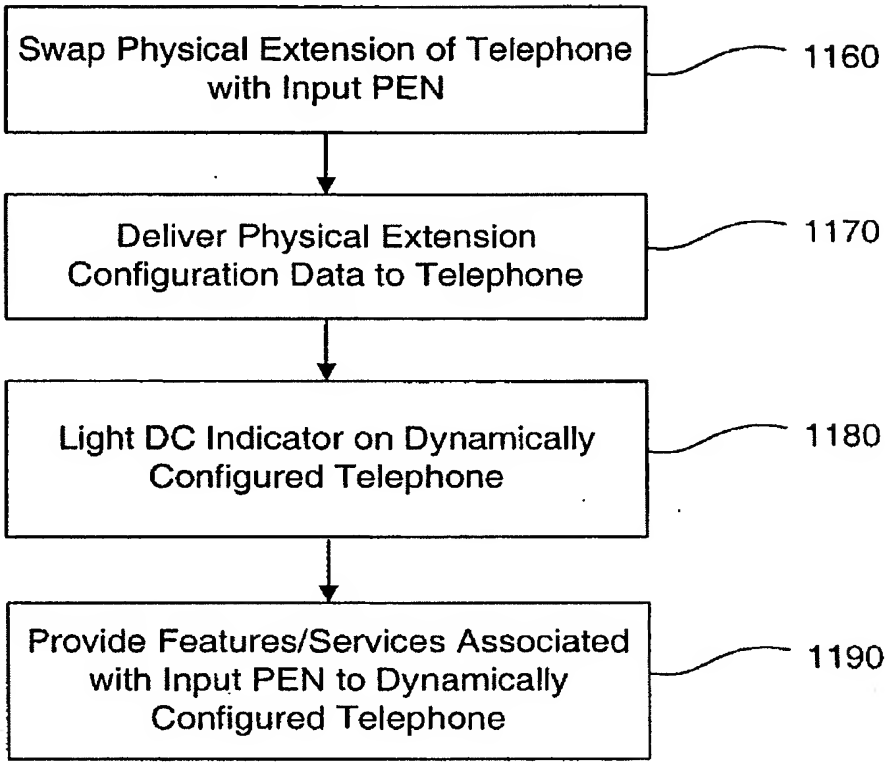

Swap Physical Extension of Telephone with Input PEN
1160
Deliver Physical Extension Configuration Data to Telephone
1170
Light DC Indicator on Dynamically Configured Telephone
1180
Provide Features/Services Associated with Input PEN to Dynamically Configured Telephone
1190

FIG. 11B

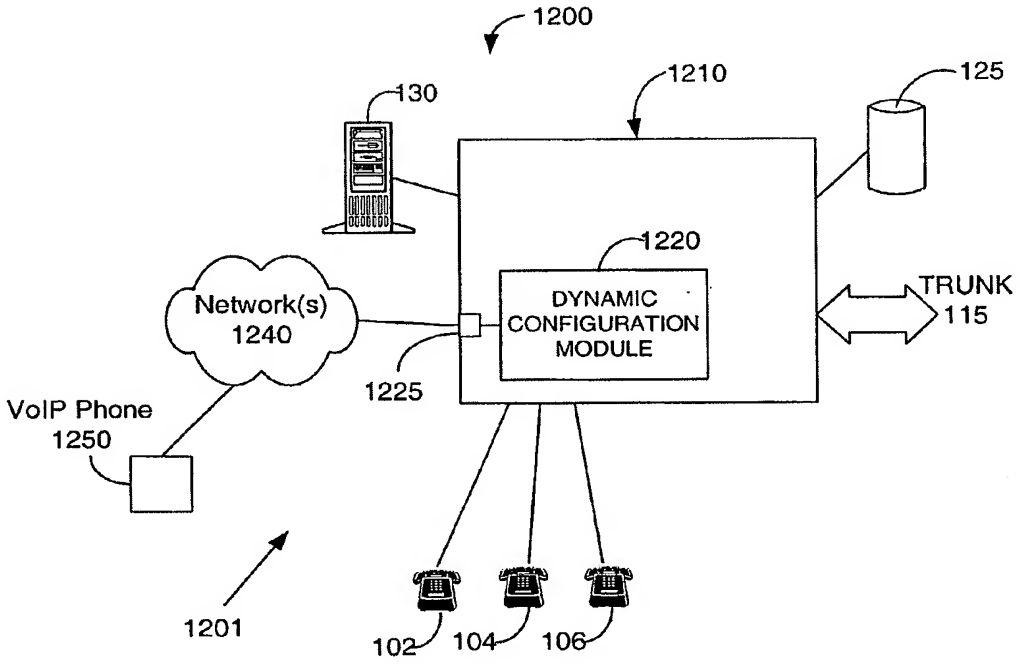

1200
1210
130
125
1220
DYNAMIC CONFIGURATION MODULE
Network(s) 1240
TRUNK 115
1225
VoIP Phone 1250
1201
102
104
106

FIG. 12

1300

Virtual Extensions	User ID	Physical Phone Features including button map with DC button
3002	1	
3004	2	
3006	3	
Remote VoIP Phone	Network Port (and IP address of phone)	

FIG. 13

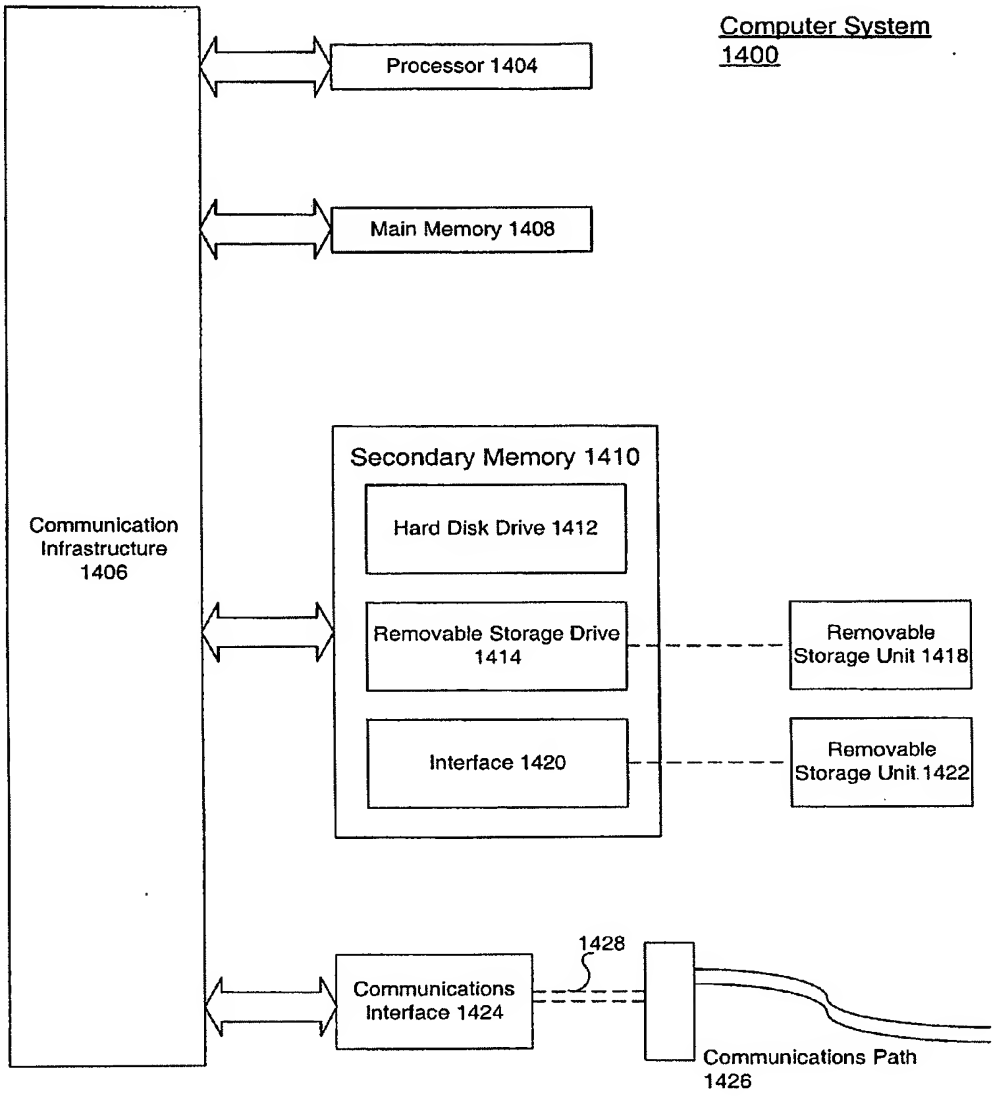

Computer System
1400
Processor 1404
Main Memory 1408
Secondary Memory 1410
Hard Disk Drive 1412
Removable Storage Drive
1414
Interface 1420
Removable
Storage Unit 1418
Removable
Storage Unit 1422
Communication
Infrastructure
1406
1428
Communications
Interface 1424
Communications Path
1426

FIG. 14

DYNAMIC TELEPHONE CONFIGURATION

FIELD OF THE INVENTION

[0001] The present invention relates to telecommunications, and in particular to configuring terminal equipment.

BACKGROUND

[0002] A telephone system often has a number of telephones at a subscriber side. These telephones are coupled to a central office switch (CO) or private branch exchange (PBX). One or more trunk lines can couple the CO or PBX to a larger telephone network. A CO or PBX can serve one or more exchanges. An exchange is identified by a dialing prefix (3 digits are used in North America). Each telephone is assigned an extension (4 digits are used for an extension in North America). Typically these extensions are fixed during installation. See, Gilbert Held, *Voice Over Data Networks*, "Telephone Operations," Chapter 5, pp. 113-26 (McGraw-Hill Companies, Inc.: U.S.A. 1998).

[0003] A number of services or features are available in today's telephone systems. These features include call forwarding, ringing, button-map assignments, voice mail and message retrieval delivery, and others. Information identifying the particular features available at a telephone is stored in a memory at the CO or PBX. For example, a table entry associated with a particular extension can include information identifying the features available at the telephone. User settings and choices such as ring style, customized button-map assignments, greeting information and call forwarding instructions are also associated with a particular telephone. Information identifying user settings and features may be stored in memory at the telephone set or at the CO or PBX.

[0004] Once set up, all of this configuration information for a telephone is associated with a particular extension and fixed. While this may be acceptable for a telephone user who uses the same telephone at the same location, it is limiting in a variety of applications and settings. The limitations are especially burdensome when users need to be able to access multiple telephones at multiple locations. The effort a user expends optimizing settings and features for a particular telephone is lost when the user needs to use a different telephone at another location. This can impair productivity as a user may not be able to leverage available telephone features effectively.

[0005] For example, in some workplaces, a user may often work at multiple locations splitting time between a private office and a laboratory. Both of these locations may have telephones; however in many cases, the user may not be able to configure the laboratory telephone because it is shared by multiple users. This can cause frustration and limit productivity as a user may not be able to leverage certain telephone features while in the laboratory at a different extension and telephone.

[0006] Similarly, in many environments, telephones may be used by a number of different people. For example, a realty company may have several different extensions available at an office. Because the number of realtors can exceed the number of telephones, it is often impractical to assign each realtor a dedicated extension and telephone. Instead, the realtors are expected to share telephones on an as needed basis as they are available. Realtors may access the telephones at different times depending upon their schedules, the availability of the telephone or the office associated with the telephone, etc. This means a realtor is unable to customize settings for a particular telephone because he or she must move across different telephones. Configuring a particular extension is then limited to a relatively generic set up that will be acceptable to many different users.

SUMMARY OF THE INVENTION

[0007] The present invention provides dynamic telephone configuration. Embodiments include a virtual configure mode and/or a physical configure mode. In a virtual configure mode, a user inputs a virtual extension. The input virtual extension is associated with the physical extension of the telephone being dynamically configured (DC). The DC telephone is then operated as if it were associated with the virtual extension input by the user. In the physical configure mode, a user inputs a physical extension. The input physical extension is swapped with the physical extension of the telephone being dynamically configured. The DC telephone is then operated as if it were associated with the physical extension input by the user.

[0008] In some embodiments, users can draw upon configuration information at any location within a telephone system. Being able to leverage configuration information from any telephone in a telephone system is especially beneficial to users who need to use a telephone temporarily (such as a worker using a telephone at a temporary workspace) or for several users who share a common pool of telephones (such as workers using desks with telephones on an as needed basis).

[0009] In embodiments, dynamic telephone configuration functionality can be implemented in software, firmware, hardware, or any combination thereof. Further embodiments, features, and advantages of the present invention, as well as the structure and operation of the various embodiments of the present invention, are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0010] The accompanying drawings, which are incorporated herein and form a part of the specification, illustrate the present invention and, together with the description, further serve to explain the principles of the invention and to enable a person skilled in the pertinent art to make and use the invention.

[0011] **FIG. 1** is a block diagram of a system for providing dynamic configuration of telephones in a telephone system according to embodiments of the present invention.

[0012] **FIG. 2** is a flowchart diagram of a routine for initializing a dynamically configurable switch with physical and virtual extensions according to an embodiment of the present invention.

[0013] **FIG. 3A** is a table illustrating stored physical extension configuration data.

[0014] **FIG. 3B** is a table illustrating stored virtual extension configuration data.

[0015] **FIGS. 4A-4B** are a flowchart diagram of a routine for dynamic configuration of a telephone with virtual extensions according to an embodiment of the present invention.

[0016] **FIG. 5** is a diagram of a panel including a display screen for a telephone according to an embodiment of the present invention.

[0017] **FIG. 6** is a flowchart diagram that illustrates processing of an inbound call in a dynamically configurable switch according to an embodiment of the present invention.

[0018] **FIG. 7** is a flowchart diagram that illustrates processing of inbound messages for services supported by a dynamically configurable switch according to an embodiment of the present invention.

[0019] **FIG. 8** is a flowchart diagram that illustrates processing of inputs from a telephone at a dynamically configurable switch according to an embodiment of the present invention.

[0020] **FIG. 9** is a flowchart diagram of a routine for initializing a dynamically configurable switch with physical extensions according to an embodiment of the present invention.

[0021] **FIG. 10** is a table illustrating swapped physical extension configuration data after roaming.

[0022] **FIGS. 11A-11B** are a flowchart diagram of a routine for dynamic configuration of a telephone with physical extensions according to an embodiment of the present invention.

[0023] **FIG. 12** is a block diagram of a system for providing dynamic configuration of telephones including a remote VoIP telephone in a telephone system according to an embodiment of the present invention.

[0024] **FIG. 13** is a table illustrating stored physical extension configuration data including a network port extension according to an embodiment of the present invention.

[0025] **FIG. 14** is a block diagram of a computer system platform in an embodiment of the present invention.

[0026] The present invention will now be described with reference to the accompanying drawings. In the drawings, like reference numbers may indicate identical or functionally similar elements. Additionally, the left-most digit(s) of a reference number may identify the drawing in which the reference number first appears.

DETAILED DESCRIPTION OF EMBODIMENTS

[0027] The present invention allows users to dynamically configure telephones in a telephone system.

1. System

[0028] **FIG. 1** is a diagram of a system **100** for providing dynamic configuration according to an embodiment of the present invention. System **100** includes a telephone system **101** made up of telephones **102, 104, 106** coupled through links **105** to a switch **110**. Switch **110** couples telephone system **101** and trunk **115**. Switch **110** can be any type of switch or device for directing inbound and outbound telephone calls to and from telephones **102, 104, 106** and trunk **115**. For example, switch **110** can be a private branch exchange (PBX) or a central office (CO) switch.

[0029] Switch **110** includes physical and/or virtual extensions. Each physical extension corresponds to a link to a respective telephone **102, 104, 106**. Each virtual extension corresponds to a respective user of telephone system **101**. A provisioning tool **130** is also coupled to switch **110**. Provisioning tool **130** can be a control program that enables a system administrator to provision physical and virtual extensions at switch **110**. A memory **125** is also coupled to switch **110**. Memory **125** stores data that identifies the provisioned physical and virtual extensions and other associated information.

[0030] Switch **110** further includes a dynamic configuration module **120** according to an embodiment of the present invention. Dynamic configuration module **120** can be integral with switch **110** or provided as a separate device coupled to switch **110**. Dynamic configuration module **120** associates a physical extension of a telephone with a virtual extension input by user at the telephone. In this way, features associated with the virtual extension input by user can be delivered to the telephone, regardless of an initial provisioning or configuration of the physical extensions by switch **110**.

[0031] Dynamic configuration module **120** can be operated in a virtual configure mode or a physical configure mode. The virtual configure mode involves virtual extensions and physical extensions, and is described below with respect to **FIGS. 2-8**. Physical configure mode involves physical extensions only, and is described below primarily with respect to **FIGS. 9-11**. In some embodiments, both the virtual configure mode and the physical configure mode can support operation with a remote voice-over IP phone, as described further below with respect to system **1200** in **FIG. 12** and **FIG. 13**. Dynamic configuration module **120** can be implemented in software, firmware, hardware, and/or any combination thereof. An example computer platform supporting a software embodiment is described below with respect to **FIG. 14**.

2. Virtual Configure Mode

[0032] A. Initialization

[0033] **FIG. 2** is a flowchart diagram of a routine **200** for initializing a dynamically configurable switch with physical and virtual extensions according to an embodiment of the present invention (steps **210-240**). In step **210**, physical extensions are initialized. Available physical extensions are associated with available physical ports and associated phone features. For example, in North America, a 4-digit number is used to identify a physical extension. Each physical extension is associated with a particular link to a telephone. In the simple example of three telephones **102, 104, 106** in **FIG. 1**, three different 4-digit extensions (**3002, 3004, 3006**) can be assigned. Physical ports in switch **110** that lead to corresponding telephones **102, 104, 106** are then associated with the respective physical extensions. Physical phone features may also be associated with the physical extensions. Such physical phone features can be any phone system setting, user setting or service choice, including but not limited to, button-map assignments, ring style, call forwarding, call waiting, transfer, hold, greeting style, etc.

[0034] In step **220**, the initialized physical extension configuration data is stored in memory. For example, memory **125** in **FIG. 1** can be a database that stores physical extension configuration data. **FIG. 3A** shows, in tabular form, physical extension configuration data, including but not limited to physical extensions, physical ports, and physi-

cal phone feature information. In the example shown in **FIG. 3A**, Table **300** includes a first entry having fields that associates physical extension **3002** with physical port **1** of switch **110** and physical phone feature information. A second entry is provided that associates physical extension **3004** with physical port **2** and physical phone feature information. A third entry is provided for physical extension **3006** and associated physical port **3** and physical phone feature information. Referring to **FIG. 1**, in one implementation, memory **125** is a database, and provisioning tool **130** is an application that supports Virtual Mail Manager Interface (VMMI) programming. A system administrator using provisioning tool **130** can be provided with a series of control menus through a graphical user interface. Such control menus enable the system administrator to easily identify and/or edit physical extensions (e.g., add/modify/delete), associated ports and associated physical phone features in carrying out initialization step **210**. Records can be generated for each provisioned physical extension and can be stored in the database in memory **125**.

[0035] Returning to **FIG. 2**, in step **230**, virtual extensions are initialized. Virtual extensions are initialized similarly to the physical extensions described above with respect to step **210**. For example, in step **230**, virtual extensions are associated with physical phone features. Virtual extensions, however, are generally associated with a user of telephone system **101**. Virtual extensions can also be identified by a 4-digit number and further associated with a user identification (ID), such as a user name. The physical phone features associated with virtual extensions can be any phone system setting, user setting or service choice, including but not limited to, button-map assignments, ring style, call forwarding, call waiting, transfer, hold, greeting style, etc. According to an embodiment of the present invention, mapping information can also be associated with virtual extensions. Such mapping information is used to map a virtual extension to a physical port at a telephone during the dynamic configuration of the telephone. This mapping is described further below with respect to routine **400** in **FIG. 4**.

[0036] In step **240**, virtual extension configuration data is stored. In the embodiment of **FIG. 1**, virtual extension configuration data is stored in memory **125**. **FIG. 3B** shows, in tabular form, virtual extension configuration data, including but not limited to virtual extensions, user ID, mapping information, and physical phone feature information. In the example in **FIG. 3B**, Table **320** includes a first entry having fields that associates virtual extension **3002** with user Jimi of switch **110** and physical phone feature information. A second entry is provided that associates virtual extension **3004** with user Bob and physical phone feature information. A third entry is provided for virtual extension **3006** with user Janis and physical phone feature information. A fourth entry is provided for virtual extension **3008** with user Ben and physical phone feature information. In the embodiment of **FIG. 1**, each virtual extension includes mapping information for logically mapping the virtual extension to a physical port as described further below with respect to **FIG. 4**.

[0037] B. Operation

[0038] **FIGS. 4A and 4B** are a flowchart diagram of a routine **400** for dynamic configuration of a telephone with virtual extensions according to an embodiment of the present invention (steps **410-490**). In step **410**, dynamic configuration (DC) at a telephone is initiated. For example, although a user may have access to a telephone, such as telephone **106** in telephone system **101** in **FIG. 1**, the telephone **106** may not be configured to provide the user access to one or more features available to the telephone **106**. The present invention allows the user to initiate dynamic configuration at telephone **106**. For example, the user can press a particular DC button or a combination of buttons at telephone **106**. In some embodiments, initiation of dynamic configuration may be voice-automated. For example, the user may provide a voice command to initiate dynamic configuration of the telephone **106**. Once dynamic configuration is initiated, dynamic configuration module **120** presents a prompt for a virtual extension number (step **420**). The user then inputs the virtual extension number to satisfy the prompt (step **430**). For example, the prompt may appear in a display at telephone **106**. The user then enters through the keypad at telephone **106** his or her virtual extension.

[0039] Returning to **FIG. 4**, a check is made at step **435** to determine whether the virtual extension entry is valid. In an embodiment, this check is carried out by dynamic configuration module **120** in **FIG. 1** in response to the information input by the user at telephone **106**. If the virtual extension number is not a valid extension number, then control proceeds to step **436** and routine **400** ends. If the entry is valid, then control proceeds to step **440**. In step **440**, dynamic configuration module **120** presents a prompt for a password to the user at telephone **106**. For example, dynamic configuration module **120** can send instructions to telephone **106** to display a prompt to the user to input a password. In step **450**, user responds to the prompt and inputs a password for telephone **106**. As with step **430**, the user can use the keypad of the telephone **106** to input a password. Dynamic telephone **106** then sends this input to dynamic configuration module **120**. Dynamic configuration module **120** checks the password entry to determine whether it is valid. If the entry is not valid, then control proceeds to step **456** and routine **400** ends. If the entry is valid, then control proceeds to step **460** (see **FIG. 4B**).

[0040] In step **460**, dynamic configuration module **120** associates the physical extension of a telephone from which the valid virtual extension number and password are received, in steps **430** and **450**, with the virtual extension number input in step **430**. For instance, consider the example where a user, Jimi, with virtual extension **3002** initiates dynamic configuration at telephone **106**. Telephone **106** is coupled to switch **110** at a physical port **3** as shown in table **300**. Dynamic configuration module **120** then looks up physical port **3** to determine physical extension **3006**. Since Jimi inputs his virtual extension number **3002**, dynamic configuration module **120** associates virtual extension **3002** with physical port **3**, as shown in Table **320** in **FIG. 3B**. Dynamic configuration module **120** in **FIG. 1** may write mapping information into a field in an appropriate record in database **125**, so that the virtual extension **3002** is now associated with physical port **3**.

[0041] In step **470**, virtual extension configuration data is then delivered over the physical port to the dynamically configured telephone. For example, prior to Jimi dynamically configuring telephone **106**, the configuration data at the telephone was probably either a default configuration or a configuration of another user. Because of Jimi's initiating

dynamic configuration, virtual extension configuration data associated with virtual extension **3002** is then sent to telephone **106** through port **3**. Such virtual extension configuration data can include data needed for telephone **106** to support the particular phone features associated with the virtual extension. **FIG. 4** is illustrative and not intended to limit the present invention. For example, the virtual configuration data can be stored in a memory coupled to the switch in some embodiments.

[0042] In step **480**, dynamic configuration module **120** in **FIG. 1** sends a signal to indicate to telephone **106** that a dynamic configuration indicator should be lit on telephone **106**. For example, an indicator above the dynamic configuration button can be lit to notify the user that the dynamic configuration is complete. This example is illustrative only. Other types of indicators can be used.

[0043] **FIG. 5** is a diagram of a panel **500** that includes a display screen **510** for a telephone, such as telephone **106** in **FIG. 1**, according to an embodiment of the present invention. Panel **500** also includes buttons **520** for activating different phone features, such as call waiting, multiple lines, forwarding, hold, transfer, or call conferencing. Panel **500** includes a keypad **540** that may include numeric characters and any other characters for carrying out telephone operation. Additional buttons may also be provided for special features. As shown in **FIG. 5**, a dynamic configuration button **530** is provided to enable a user to easily initiate dynamic configuration in step **410**, as described above. An indicator **532** such as a visible light-emitting diode is provided near button **530**. For instance, indicator **532** can be lit as described with respect to step **480** when dynamic configuration has been carried out. Panel **500** is illustrative and not intended to limit the present invention.

[0044] Referring again to **FIG. 4**, in step **490**, features associated with the virtual extension input in step **430** are provided to the dynamically configured telephone. User, Jimi, at telephone **106** in **FIG. 1**, then receives features associated with the virtual extension to which he may be accustomed. At this point, switch **110** operates in a conventional manner to support and deliver telephone features and services to telephone **106**, as if the user Jimi and his virtual extension number were initially configured as being associated a physical extension at telephone **106**. Step **490** is described further below with respect to specific operations in **FIGS. 6-8**.

[0045] **FIG. 6** is a flowchart diagram **600** that illustrates processing of an inbound call in a dynamically configurable switch **110** in **FIG. 1** according to an embodiment of the present invention. In step **610**, an inbound call to a virtual extension number (VEN) is received over trunk **115** at switch **110**. Switch **110** then looks up the physical port based on the virtual extension number identified in the inbound call (step **620**). This lookup includes looking at the mapping information provided by dynamic configuration module **120**, as described above with respect to step **460**. Switch **110** then routes the inbound call over a physical port to the dynamically configured telephone currently being used by a user associated with the virtual extension. In this way, once the user has dynamically configured a telephone based on his or her virtual extension, switch **110** will provide inbound telephone calls to the user at the dynamically configured telephone. Switch **110** can also provide other features or messages such as voicemail message indications, as well, as will be described further below with respect to **FIG. 7**.

[0046] **FIG. 7** is a flowchart diagram that illustrates a routine **700** for processing inbound messages for services supported by a dynamically configurable switch **110** in **FIG. 1**, according to an embodiment of the present invention. In step **710**, switch **110** receives messages associated with a virtual extension. For example, such messages may be sent by a voicemail application to notify a user that a voicemail message has been received and is waiting for retrieval. Switch **110** then processes the received messages based on the virtual extension configuration data (step **720**). Switch **110** looks up the physical port based on associated virtual extension data. As described with respect to step **620** above, this physical port that is looked up has been associated during dynamic configuration with a telephone at which the user having the virtual extension is now present. In step **740**, switch **110** then delivers appropriate data over the looked up physical port to the dynamically configured telephone. For example, switch **110** may send a command to light a voicemail light in accordance with particular button map assignments associated with a user of the virtual extension.

[0047] **FIG. 8** is a flowchart diagram that illustrates a routine **800** for processing inputs made by a user at the telephone, once the telephone has been dynamically configured (steps **810-830**). In step **810**, switch **110** in **FIG. 1** receives inputs from a dynamically configured telephone on a particular physical port of switch **110**. For example, the user may press a button which corresponds to a command to retrieve voicemail. Switch **110** then looks up virtual extension configuration data (e.g., physical phone feature information in the field shown in **FIG. 3B**) associated with the physical port on which the inputs are received (step **820**). Based upon this lookup, switch **110** processes the received inputs based on the virtual extension configuration data (step **830**). For example, switch **110** may look up the virtual extension configuration data and determine that the particular button command sent by the user is associated with voice message retrieval. Switch **110** will then forward the user's command to retrieve voicemail for the appropriate voicemail application. Such a voicemail application, for example, can be running locally at switch **110**, or remotely in another part of the telephone network in telephone system **101**.

3. Physical Configure Mode

[0048] A. Initialization

[0049] **FIG. 9** is a flowchart diagram of a routine **900** for initializing a dynamically configurable switch with physical extensions, according to an embodiment of the present invention. In step **910**, physical extensions at switch **110** are initialized. Similar to the virtual configure mode initialization described above with respect to step **210**, this initialization can include initializing physical extensions, physical ports, and physical phone features for switch **110**. Physical extension configuration data is then stored (step **920**). For example, step **910** can be performed by a system administrator using provisioning tool **130**. Control menus and other screen displays can be provided to enable user to add or modify data relating to provisioning of physical extensions. In one embodiment, a user interface is provided that assists a system administrator with VMMI programming of a database stored at memory **125**. This database can be used

to store physical extension configuration data in step **920**. In one example, a table **300** can be generated and stored, as described above with respect to **FIG. 3A**.

[0050] B. Operation

[0051] In the physical configure mode, a user inputs a physical extension. The input physical extension is swapped with the physical extension of the telephone being dynamically configured (i.e. the DC telephone). The DC telephone is then operated as if it were associated with the physical extension input by the user.

[0052] For example, referring to **FIG. 1**, a user may be present at telephone **106** in telephone system **101**, rather than at telephone **102** in telephone system **101**. The user (or system administrator) may have already configured telephone **102** to make optimal use of certain features available to telephone **102**. Telephone **102**, for example, may be at a desk in a cubicle in which the user normally works. While near telephone **106**, however, the user may desire to take advantage of the features configured previously with respect to telephone **102**. The present invention allows the user to initiate dynamic configuration at telephone **106**. For example, the user can press a particular DC button at telephone **106** to initiate dynamic configuration.

[0053] **FIGS. 11A and 11B** are a flowchart diagram of a routine **1100** for dynamic configuration of a telephone with physical extensions (steps **1110-1190**). Routine **1100** operates similarly to routine **400** described above, except that virtual extensions are not used. In step **1110**, a user initiates a dynamic configuration at a telephone. For example, a user at telephone **106** can press a dynamic configuration button. In step **1120**, a prompt is presented for a user's physical extension. For example, dynamic configuration module **120** can send a command to instruct telephone **106** to display a prompt for the user's physical extension.

[0054] In step **1130**, the user inputs his or her physical extension. The user can input the physical extension through a keypad on a panel of telephone **106**.

[0055] Dynamic configuration module **120** then receives the input physical extension and performs a check to determine if the entry is valid (step **1135**). If the physical extension entry is invalid, in that it is not a physical extension associated with telephone system **101** or it is in an improper format or other error, then control proceeds to step **1136**, and routine **1100** is ended. If the entry is valid, then control proceeds to step **1140**. In step **1140**, a user is presented with a prompt for a password. For example, dynamic configuration module **120** in **FIG. 1** can send a command to telephone **106** to display a prompt for password on a panel. In step **1150**, a user inputs a password. For example, a user at telephone **106** can input a password using a keypad on a panel of telephone **106**.

[0056] In step **1155**, a check is made to determine if the password entry is valid. For example, dynamic configuration module **120** can evaluate the password inputted at telephone **106** and sent to dynamic configuration module **120**. If the password is not valid, then control proceeds to step **1156**, and routine **1100** ends. If the entry is valid, then control proceeds to step **1160**.

[0057] As shown in **FIG. 11B**, in step **1160** the physical extension of the telephone to be dynamically configured is swapped with the physical extension input by the user in step **1130**. Dynamic configuration module **120** swaps the physical port information associated with the physical extension of the telephone to be configured and the physical extension input by the user. **FIG. 10** shows in tabular form how physical port information may be changed in step **1160**. Table **1010** is identical to table **300** described previously, except that the physical ports for physical extensions **3002** and **3006** have been swapped. For example, this would occur when a user (Jimi) inputs physical extension **3002** in step **1130** at telephone **106** associated with physical extension **3006**. In step **1160**, then, dynamic configuration module **120** swaps the physical port **3** information formerly associated with physical extension **3006**, for the physical port **1** information associated with the physical extension **3002** input by the user.

[0058] Steps **1170-1190** then proceed similar to steps **470-490** in **FIG. 4B**, described above. In step **1170**, physical extension configuration data is delivered to the telephone that is being dynamically configured. Such physical extension configuration data can include information relating to the physical phone features, including but not limited to button map assignments, call forwarding, call waiting, forward, transfer and hold, and other features and/or services of telephone network **101**. **FIG. 11** is illustrative and not intended to limit the present invention. For example, the physical configuration data can be stored in a memory coupled to the switch in some embodiments.

[0059] In step **1180**, a dynamic configuration indicator is lit on the dynamically configured telephone. For example, dynamic configuration module **120** can send a command to telephone **106** to indicate that the telephone **106** has been dynamically configured. In step **1190**, features associated with the input physical extension are then provided to the dynamically configured telephone. In other words, switch **110** operates to process inbound calls and inbound messages and inputs from the telephone, as described previously with respect to step **490** and **FIGS. 6-8**.

[0060] For example, to process inbound calls directed to the physical extension input by the user, switch **110** looks up physical port information associated with the physical extension and then routes the calls accordingly. In this way, inbound calls are routed to a dynamically configured telephone, based on the physical extension input by the user during dynamic configuration. Similarly, messages received from applications such as voicemail applications or other telephone service applications that are directed to a physical extension, are similarly processed by switch **110**. Switch **110** identifies physical port information associated with the physical extension and delivers it to the dynamically configured telephone accordingly.

[0061] Inputs made at the dynamically configured telephone are likewise received at a physical port associated with the dynamically configured telephone. Switch **110**, however, looks up the physical extension associated with the physical port, and because of the swapping described with respect to step **1160**, processes the inputs based on the appropriate phone features and other configuration data associated with the physical extension input by the user during dynamic configuration.

4. Remote VoIP Phone

[0062] According to a further feature of the present invention, dynamic configuration can also be carried out for telephones with a telephone system that includes remote phones. Referring to **FIG. 12**, system **1200** includes a switch **1210** and a dynamic configuration module **1220**. Switch **1210** and dynamic configuration module **1220** operate similarly to switch **110** and dynamic configuration module **120** respectively, described in detail above. For example, system **1200** includes provisioning tool **130** and memory **125** coupled to switch **1210**. Switch **1210** couples telephones in a telephone system **1201** to trunk **115**. In this embodiment, telephone system **1201** also includes a voice over IP (VoIP) phone **1250** coupled to switch **1210** over a network **1240** through port **1225** in switch **1210**. Switch **1210** then includes physical ports for coupling telephones **102, 104, 106** and port **1225** for coupling a remote VoIP phone **1250**. In one example, port **1225** is any type of communication port including but not limited to a network port for coupling to a network, such as the Internet.

[0063] System **1200** operates like system **100** in **FIG. 1** described above. One difference is provisioning tool **130** provisions physical extensions for each of the physical ports coupled to telephones **102, 104** and **106**, and further provisions a physical extension for the remote phone **1250**. In this case, the provisioning is made for a network port. Otherwise, switch **1210** and dynamic configuration module **1220** can operate to support a virtual configure mode and/or a physical configure mode, as described above with respect to **FIGS. 2-11**.

[0064] **FIG. 13** shows, in tabular form, virtual extension configuration data, including but not limited to virtual extensions, user IDs, and physical phone feature information. In the example shown in **FIG. 13**, Table **1300** includes a first entry having fields that associates virtual extension **3002** with user ID **1** and physical phone feature information. A second entry is provided that associates virtual extension **3004** with user ID **2** and physical phone feature information. A third entry is provided for virtual extension **3006** and associated user ID **3** and physical phone feature information. A fourth entry is provided that associates a remote VoIP phone with a network port and physical phone feature information. The remote VoIP phone may be associated with an IP address of a telephone **102, 104, 106** in the telephone system **101**, for example.

[0065] The present invention can be implemented in any telephone system, including but not limited to a telephone system FXII coupled to IPRIMO telephones both available from Comdial Corporation, a Delaware corporation. Telephones **102, 104, 106** are illustrative and not intended to limit the present invention. Telephones **102, 104, 106** can be any type of telephone, including but not limited to, a digital telephone available from Comdial such as an Impact telephone, an internet protocol (IP) telephone such as an IPRIMO telephone, or other type of telephone or terminal equipment. As used herein, the term "telephone" refers to any type of terminal equipment or device for coupling at least voice and/or data to a telephone system.

[0066] Switches **110, 1210** can be any type of switch including but not limited to a private branch exchange (PBX) or central office switch. Trunk **115** is illustrative, and in general the present invention can be used with any type and any number of trunk lines depending upon the capacity of switches **110, 1210**.

5. Computer System Platform

[0067] The present invention including dynamic configuration modules **120, 1220** may be implemented using hardware, software or a combination thereof and may be implemented in a computer system or other processing system. In an embodiment, the invention is directed toward a computer program product executing on a computer system capable of carrying out the functionality described herein, particularly that of dynamic configuration modules **120, 1220**. An example of a computer system **1400** is shown in **FIG. 14**. The computer system **1400** includes one or more processors, such as processor **1404**. The processor **1404** is connected to a communication infrastructure **1406**. such as a communication bus. Various software embodiments are described in terms of this example computer system. After reading this description, it will become apparent to a person skilled in the relevant art how to implement the invention using other computer systems and/or computer architectures.

[0068] Computer system **1400** also includes a main memory **1408**, preferably random access memory (RAM), and may also include a secondary memory **1410**. The secondary memory **1410** may include, for example, a hard disk drive **1412** and/or a removable storage drive **1414**, representing a floppy disk drive, a magnetic tape drive, an optical disk drive, etc. The removable storage drive **1414** reads from and/or writes to a removable storage unit **1418** in a well-known manner. Removable storage unit **1418**, represents a floppy disk, magnetic tape, optical disk, etc. which is read by and written to by removable storage drive **1414**. As will be appreciated, the removable storage unit **1418** includes a computer usable storage medium having stored therein computer software and/or data.

[0069] In alternative embodiments, secondary memory **1410** may include other similar means for allowing computer programs or other instructions to be loaded into computer system **1400**. Such means may include, for example, a removable storage unit **1422** and an interface **1420**. Examples of such may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket, and other removable storage units **1422** and interfaces **1420** which allow software and data to be transferred from the removable storage unit **1422** to computer system **1400**.

[0070] Computer system **1400** may also include a communications interface **1424**. Communications interface **1424** allows software and data to be transferred between computer system **1400** and external devices. Examples of communications interface **1424** may include a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, etc. Software and data transferred via communications interface **1424** are in the form of signals **1428** which may be electronic, electromagnetic, optical or other signals capable of being received by communications interface **1424**. These signals **1428** are provided to communications interface **1424** via a communications path (i.e., channel) **1426**. This channel **1426** carries signals **1428** and may be implemented using wire or cable, fiber optics, a

phone line, a cellular phone link, an RF link and other communications channels. In an embodiment of the invention, signals **1428** comprise input values, multiplier X and multiplicand Y. Alternatively, these values can be read from secondary memory **1410**.

[0071] In this document, the terms "computer program medium" and "computer usable medium" are used to generally refer to media such as removable storage drive **1414**, a hard disk installed in hard disk drive **1412**, and signals **1428**. These computer program products are means for providing software to computer system **1400**.

[0072] Computer programs (also called computer control logic) are stored in main memory **1408** and/or secondary memory **1410**. Computer programs may also be received via communications interface **1424**. Such computer programs, when executed, enable the computer system **1400** to perform the features of the present invention as discussed herein. In particular, the computer programs, when executed, enable the processor **1404** to perform the features of the present invention. Accordingly, such computer programs represent controllers of the computer system **1400**.

[0073] In an embodiment where the invention is implemented using software, the software may be stored in a computer program product and loaded into computer system **1400** using removable storage drive **1414**, hard drive **1412** or communications interface **1424**. The control logic (software), when executed by the processor **1404**, causes the processor **1404** to perform the functions of the invention as described herein.

[0074] In another embodiment, the invention is implemented primarily in hardware using, for example, hardware components such as application specific integrated circuits (ASICs). Implementation of the hardware state machine so as to perform the functions described herein will be apparent to persons skilled in the relevant art(s).

[0075] The present invention is advantageous in a variety of applications. Being able to leverage configuration information from any telephone in a telephone system is especially beneficial to users who need to use a telephone temporarily (such as a worker using a telephone at a temporary workspace) or for several users who share a common pool of telephones (such as workers using desks with telephones on an as needed basis). Users can then customize phone features and leverage this customization at any dynamically configurable telephone in a telephone system. This can improve efficiency and utilization of telephone features, such as, configurable button assignments, voice mail, call forwarding, conferencing, hold, transfer, call waiting and/or any other telephone feature. Embodiments of the invention can cover a variety of platforms and applications.

6. CONCLUSION

[0076] The present invention can be implemented in software, firmware, hardware or any combination thereof. In examples, the present invention can be implemented in control logic in an processing device, including but not limited to, a general purpose computer, specific purpose computer, server, workstation, personal computer (desktop, laptop, or palm top), personal digital assistant (PDA), network appliance, network component (e.g., switch), telephone unit, game console, or a set-top box.

[0077] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example, and not limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention.

1. A system for enabling users to dynamically configure telephones in a telephone system, comprising:

a switch that directs telephone calls carried between telephones and at least one trunk, said switch including physical and virtual extensions, wherein each physical extension corresponds to a link to a respective telephone and each virtual extension corresponds to a respective user; and

a dynamic configuration module that associates a physical extension of a telephone with a virtual extension input by a user, whereby features associated with the virtual extension input by the user are delivered to the telephone.

2. The system of claim 1, wherein said switch comprises a private branch exchange.

3. The system of claim 1, wherein said switch comprises a central office switch.

4. The system of claim 1, wherein said dynamic configuration module delivers virtual extension configuration data to the telephone.

5. The system of claim 1, wherein said switch supports the features or services delivered to the telephone.

6. The system of claim 1, further comprising a memory coupled to said switch and said dynamic configuration module.

7. The system of claim 6, wherein said memory stores a first group of data including associated physical extensions, ports and phone features.

8. The system of claim 7, wherein said memory stores a second group of data including virtual extensions, user identifiers, phone features, and mapping information, and

wherein said dynamic configuration module sends mapping information to said memory that associates the physical extension of the telephone with the virtual extension input by the user.

9. The system of claim 8, wherein said phone features include at least one selected from the group of call forwarding, voice mail, button-map assignments, conference calling, call waiting, hold, and transfer.

10. The system of claim 1, wherein the telephone includes an input for toggling on and off dynamic configuration of the telephone by a user, and an indicator for indicating whether dynamic configuration is on or off.

11. The system of claim 10, wherein said input comprises a button on a panel of the telephone, and said indicator comprises a visible indicator on the panel.

12. The system of claim 1, wherein said switch further includes a port for enabling an administrator to provision physical and virtual extensions.

13. The system of claim 1, wherein said switch further includes a network port for coupling a VoIP telephone to said switch.

14. The system of claim 1, wherein said dynamic configuration module checks whether the virtual extension input by the user is valid and a password input by the user is valid

before associating the physical extension of the telephone with the virtual extension input.

15. A system for enabling users to dynamically configure telephones in a telephone system, comprising:

a switch that couples telephones and at least one trunk, said switch including physical extensions, wherein each physical extension corresponds to a link to a respective telephone; and

a dynamic configuration module that associates a physical extension of a telephone with a physical extension input by a user, whereby features associated with the physical extension input by the user are delivered to the telephone.

16. The system of claim 15, wherein said switch comprises at least one of a private branch exchange and a central office switch.

17. The system of claim 15, further comprising a memory coupled to said switch and said dynamic configuration module.

18. The system of claim 17, wherein said memory stores a first group of data including associated physical extensions, ports and phone features.

19. The system of claim 18, wherein said dynamic configuration module swaps port information stored in said memory so as to associate the physical extension of the telephone with the physical extension input by the user.

20. The system of claim 15, wherein said switch further includes a network port for coupling a VoIP telephone to said switch.

21. In a telephone system having a switch that couples telephones and at least one trunk, the switch including physical and virtual extensions, wherein each physical extension corresponds to a link to a respective telephone and each virtual extension corresponds to a respective user, a method for dynamically configuring a first telephone for use by a first user comprising:

receiving a virtual extension input by the first user through the first telephone; and

associating a physical extension of the first telephone with the input virtual extension, whereby features associated with the input virtual extension are delivered to the first telephone.

22. The method of claim 21, further comprising presenting a first prompt at the first telephone that requests input of the virtual extension.

23. The method of claim 22, further comprising presenting a second prompt at the first telephone that requests input of a password associated with the first user.

24. The method of claim 23, further comprising checking whether the virtual extension input and password input are valid prior to said associating step.

25. The method of claim 23, further comprising illuminating an indicator of the first telephone in response to the physical extension of the first telephone being associated with the input virtual extension.

26. The method of claim 23, further comprising providing phone features associated with the input virtual extension to the first telephone, the provided phone features including at least one phone feature selected from the group of call forwarding, voice mail, button-map assignments, conference calling, call waiting, hold, and transfer.

27. The method of claim 21, further comprising enabling an administrator to provision physical and virtual extensions at the switch.

28. The method of claim 21, further comprising:

receiving an inbound call to the input virtual extension;

looking up a physical port based on the input virtual extension; and

routing the inbound call to the first telephone at the looked up physical port.

29. The method of claim 21, further comprising:

receiving a message relating the input virtual extension; and

processing the message based on stored feature data relating to the input virtual extension;

looking up a physical port associated with the input virtual extension; and

delivering data corresponding to the processed message over the looked up physical port to the first telephone at the looked up physical port.

30. The method of claim 21, further comprising:

receiving at a physical port a signal corresponding to an input entered at the first telephone;

looking up virtual extension feature data associated with the physical data at which the signal was received; and

processing the signal based on the looked up virtual extension feature data.

31. In a telephone system having a switch that couples telephones and at least one trunk, the switch including physical and virtual extensions, wherein each physical extension corresponds to a link to a respective telephone, a method for dynamically configuring a first telephone for use by a first user comprising:

receiving a physical extension input by the first user through the first telephone; and

associating a physical extension of the first telephone with the input physical extension, whereby features associated with the input physical extension are delivered to the first telephone.

* * * * *

Appendix B: Evidence Appendix

Tab 2 - *Marcus*

US005933488A

United States Patent [19]

Marcus et al.

[11] Patent Number: 5,933,488

[45] Date of Patent: Aug. 3, 1999

[54] **AUTOMATED METHOD AND ARRANGEMENT FOR INTEGRATING A TELEPHONE SYSTEM WITH AN ANNOUNCEMENT SYSTEM**

[75] Inventors: **Rodrigo Tyrone Marcus**, San Francisco; **William Joseph Beyda**, Cupertino; **Shmuel Shaffer**, Palo Alto, all of Calif.

[73] Assignees: **Siemens Information; Communication Networks, Inc.**, both of Boca Raton, Fla.

[21] Appl. No.: **08/844,416**

[22] Filed: **Apr. 18, 1997**

[51] **Int. Cl.**[6] **H04M 3/50**; H04M 11/02

[52] **U.S. Cl.** **379/217**; 379/88.15; 379/88.16; 379/88.23; 379/164; 379/199; 379/374

[58] **Field of Search** 379/76, 217, 67.1, 379/88.16, 88.23, 88.24, 88.25, 88.26, 88.15

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4,922,526	5/1990	Morganstein et al.	379/157
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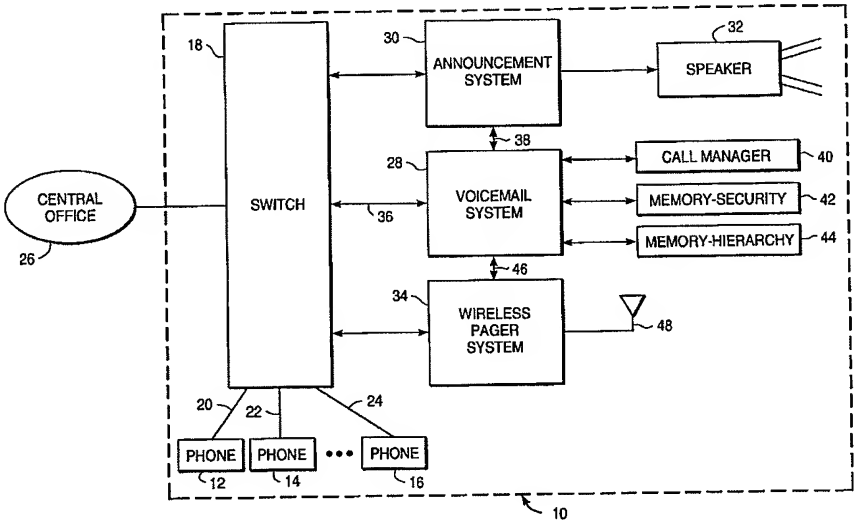
Primary Examiner—Daniel S. Hunter
Assistant Examiner—Roland G. Foster

[57] **ABSTRACT**

A method and arrangement of utilizing an announcement system to provide paging capability for a facility includes automating the integration of a telephone switch, a voicemail system, and an announcement system. An unanswered call to a telephone of the facility is forwarded to the voicemail system, establishing a first connection between the telephone of the calling party and the voicemail system. The caller is presented with the option of recording a message or initiating a broadcast of an audible page announcement. If the announcement option is selected, a second connection that is separate from the first connection is formed from the voicemail system to the announcement system. An audible announcement identifies the availability of the call for retrieval by the particular called party. In the preferred embodiment, access to the waiting call is restricted to either or both of verification of a password and verification that the retrieval is from one of a limited number of authorized telephones. Security and privacy are further enhanced by restricting access to the announcement procedure in accordance with the preferred embodiment. Multi-tier call notification may be employed, with differences in the tiers being based either upon regions of broadcast (e.g., localized versus general-facility announcements) or upon modes of paging (e.g., overhead announcements versus a page to a particular remote page device).

16 Claims, 3 Drawing Sheets



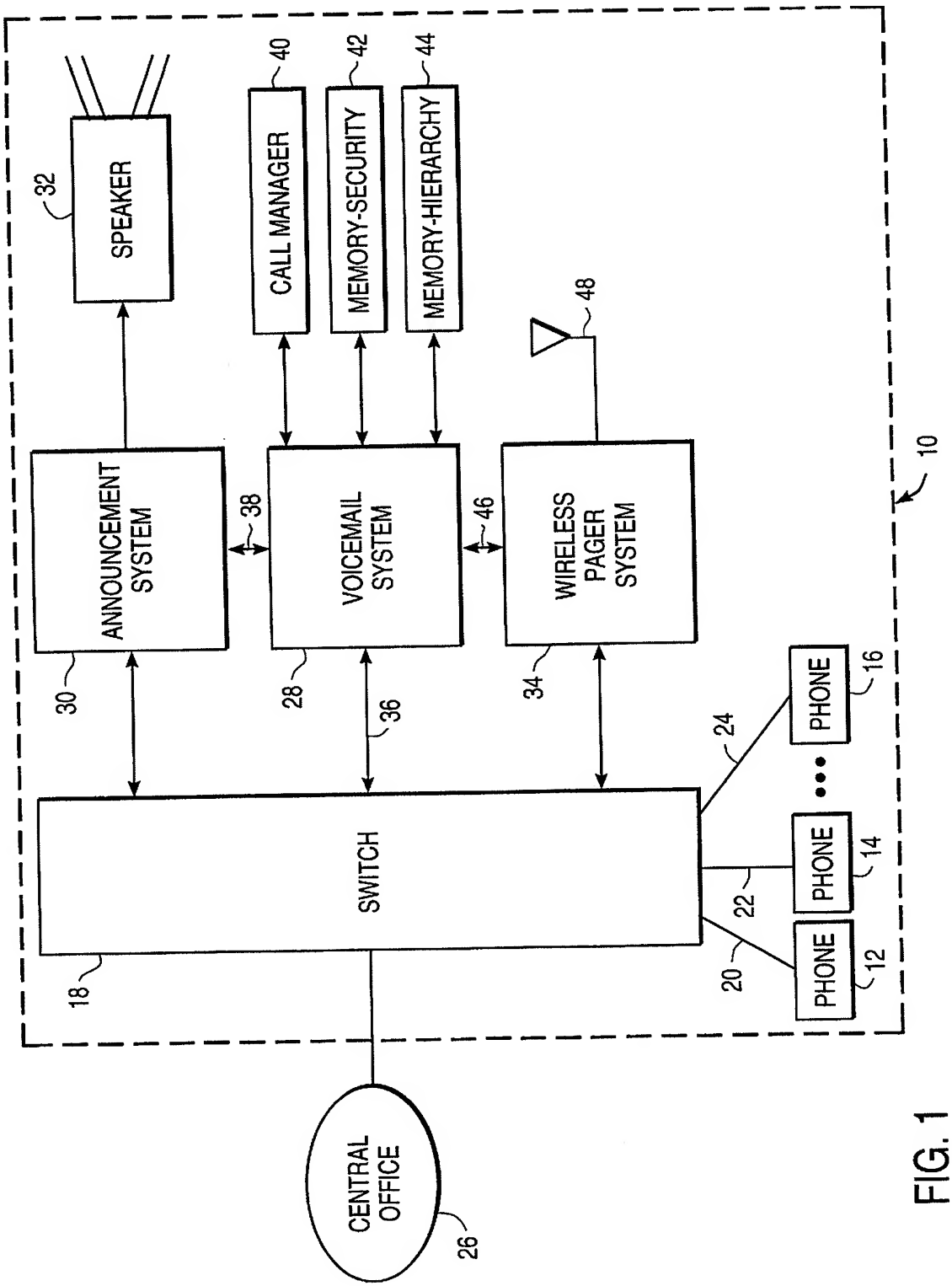

SPEAKER
32
CALL MANAGER
40
MEMORY-SECURITY
42
MEMORY-HIERARCHY
44
48
ANNOUNCEMENT SYSTEM
30
38
VOICEMAIL SYSTEM
28
46
WIRELESS PAGER SYSTEM
34
10
36
24
PHONE
16
PHONE
14
PHONE
12
22
20
SWITCH
18
CENTRAL OFFICE
26

FIG. 1

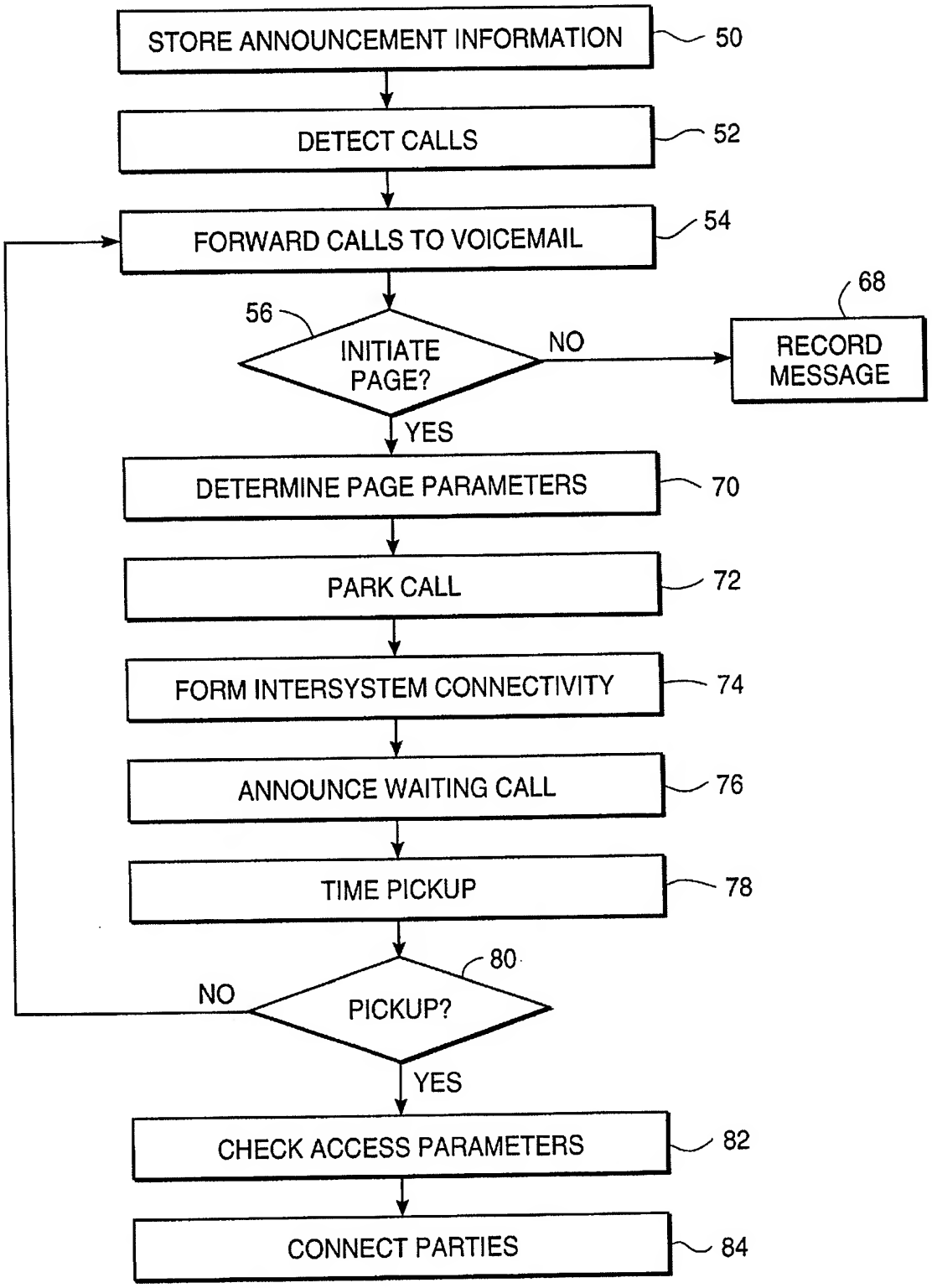

STORE ANNOUNCEMENT INFORMATION
50
DETECT CALLS
52
FORWARD CALLS TO VOICEMAIL
54
56
INITIATE PAGE?
NO
68
RECORD MESSAGE
YES
DETERMINE PAGE PARAMETERS
70
PARK CALL
72
FORM INTERSYSTEM CONNECTIVITY
74
ANNOUNCE WAITING CALL
76
TIME PICKUP
78
80
NO
PICKUP?
YES
CHECK ACCESS PARAMETERS
82
CONNECT PARTIES
84

FIG. 2

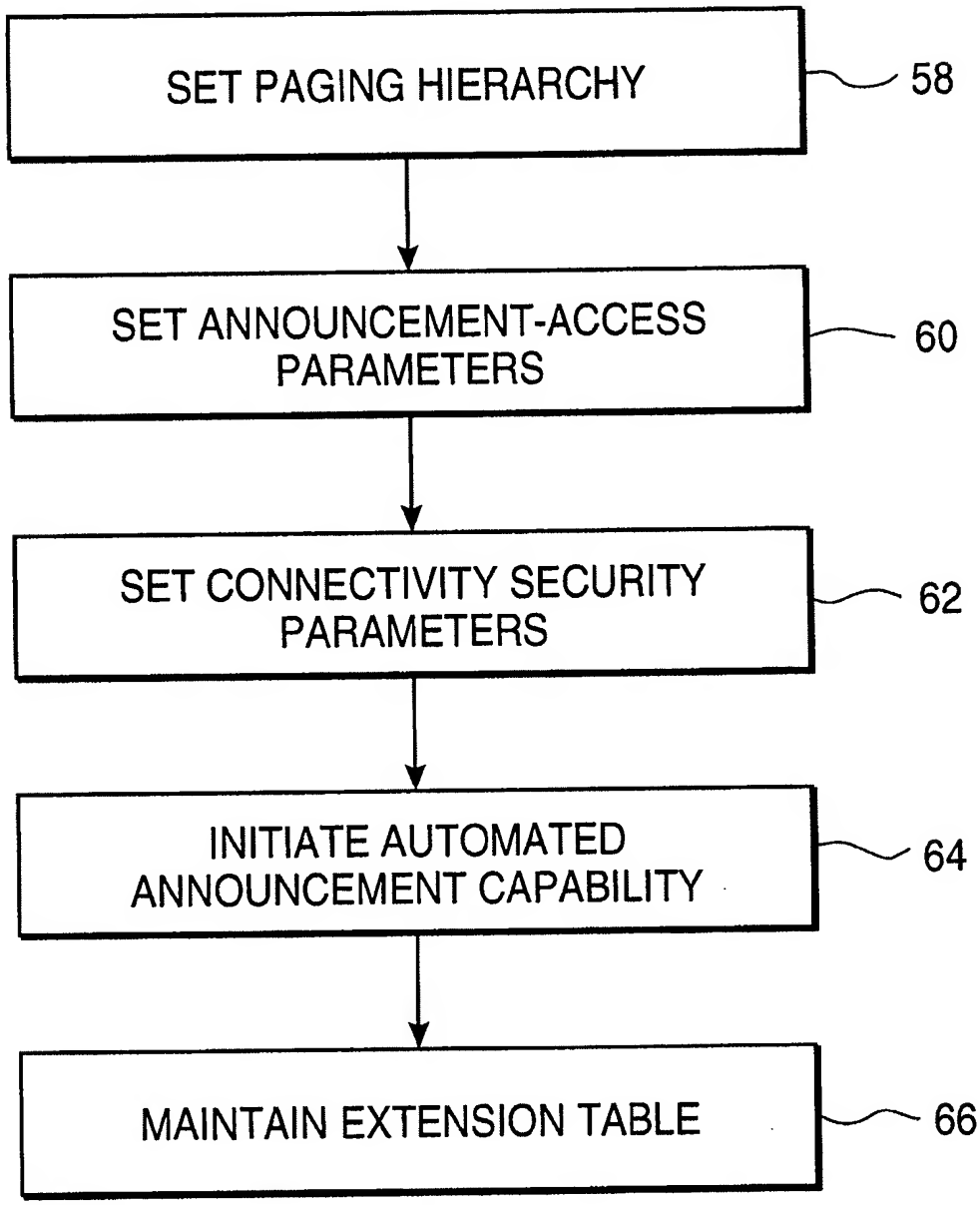

SET PAGING HIERARCHY
58
SET ANNOUNCEMENT-ACCESS PARAMETERS
60
SET CONNECTIVITY SECURITY PARAMETERS
62
INITIATE AUTOMATED ANNOUNCEMENT CAPABILITY
64
MAINTAIN EXTENSION TABLE
66

FIG. 3

AUTOMATED METHOD AND ARRANGEMENT FOR INTEGRATING A TELEPHONE SYSTEM WITH AN ANNOUNCEMENT SYSTEM

BACKGROUND OF THE INVENTION

The invention relates generally to methods and systems for notifying a called party that a waiting call is available for pickup and more particularly to automating an announcement system for a facility having multiple telephone units.

DESCRIPTION OF THE RELATED ART

A business or other facility which includes a number of telephones may include a telephone switch that allows direct inward dialing (DID) to a desk of a particular person within the facility. For example, a private branch exchange (PBX) may be used to assign a different extension number for each PBX station line that extends to a telephone. The DID feature accommodates an automatic routing of a call from outside of the facility to the telephone assigned to the called party. Routing of intra-facility calls is also automatic.

If a facility has an announcement system, such as an overhead paging system, the PBX is often configured to route unanswered calls to an operator or receptionist. For example, a telephone in the office of a cardiologist may be allowed to ring four times before the call is routed to an operator employed at a hospital. The operator greets the caller and may offer to page the cardiologist using the overhead system. If the caller requests the page, the operator places the call on hold and issues the page. The call is then monitored to determine whether a person picks up the call. The monitoring may be performed by the operator or by the PBX. Monitoring by the PBX may be implemented by setting a maximum time for which the call can be parked, and generating a ring-back to the operator if the maximum time is exceeded.

One concern with this process is that there are often privacy and security issues. In the hospital example, the parked call may be picked up by someone other than the cardiologist, since the announcement typically identifies both the doctor and the extension on which the call is parked. A calling party may be unaware that he or she is speaking to a person posing as the called party.

Another concern is that the process is labor-intensive. The operator or receptionist must speak with the calling party prior to initiating the announcement, must articulate the announcement, and must handle the ring-back calls if the paged person does not pickup the extension. For the ring-back calls, the operator may be required to take a message or to offer the option of transferring the call to a voicemail system.

Yet another concern in the use of overhead announcement systems to provide call notification involves human inconsistencies. Different persons will have different voice qualities, amplitudes, and clarifies. As a result, there may be some difficulties in understanding pages.

With the exception of the security concern, there have been improvements to the call-notification process. For example, the ring-back situation for unanswered pages may transfer a caller directly to the voicemail box of the called party in another development. U.S. Pat. No. 4,741,020 to Deal et al. describes an overhead announcement system for paging store clerks having specialized knowledge to help customers. For customers on a telephone, clerks are paged using a two-part message in which the first part, typically a department name, is determined by a button pushed by the store's telephone operator and the second part consists of the telephone line number. A typical message would be "Plumbing, line 2." The use of stored-speech messages to provide the paging standardizes the messages and announcements. However, the security issues remain. Moreover, the announcement process still requires intervention by a telephone operator of the facility.

U.S. Pat. No. 5,131,048 to Farenelli et al. describes an audio distribution system for use in homes. The system controls the broadcast of different types of signals through speakers located in various zones, using a control circuit which responds to inputs of music, intercom, page, and doorbell signals. A telephone handset at the home includes a page button. When the page button is depressed, the telephone handset generates a monaural paging signal. The system includes a page interface circuit that is responsive to the telephone handset to generate a control signal, serve as a power source to the telephone handset, and process an audio signal from the telephone handset. The system operates well within the home environment, but its application to a business facility is limited.

U.S. Pat. No. 5,541,981 to Lynn describes an automated announcement system that allows messages to be played on a public address system and/or displayed on a display device in accordance with a predefined schedule that maintains a minimum interval between messages. The system resolves conflicts between messages to be played at the same time by assigning priorities to the messages. An example of a use of the system is to play recorded announcements that inform customers of special sale events or promotions. In addition to the prerecorded messages, live announcements may be presented. The live announcements may be provided using a connection to a PBX pager output. That is, a call may be made to the PBX by a person who wishes to make an announcement. Preferably, a multi-level password protection scheme is implemented to restrict specific system functions to authorized users. The availability of a live announcement option may require input of a password.

In addition to overhead announcement systems, wireless pagers may be used to notify a party that a call is available. U.S. Pat. No. 4,825,456 to Rosenberg discloses an apparatus for providing call notification via pagers. A number of pager transmitters are connected to telephone extension lines by means of interface circuits. Each interface circuit includes a ring signal detector to detect activation of the associated telephone extension line. The detection triggers a pager transmitter activator, which activates the pager of the appropriate individual.

A similar apparatus is described in U.S. Pat. No. 4,642,425 to Guinn, Jr. et al. An incoming call is placed on hold while the pager of the called party is activated. The called party is then able to pickup the call at a local telephone within the facility. If there is a one-to-one correspondence between the calls and the pagers that are activated in response to the call, the security concerns are alleviated. However, the increase in security comes at a sacrifice of increased system costs, relative to overhead announcement systems.

What is needed is a method and arrangement for utilizing an announcement system to provide paging capability for facilities having a large number of telephones, with the utilization preferably being implemented in a cost-efficient and privacy secure manner.

SUMMARY OF THE INVENTION

A method and arrangement for utilizing an announcement system to provide paging capability includes automating

integration of a telephone switch, a voicemail system, and an announcement system of a facility having a number of telephones, with each telephone being associated with a particular user. Unanswered calls are forwarded to the voicemail system, so that a first connection is formed between the voicemail system and a telephone of the calling party. A second connection is then formed between the voicemail system and the announcement system. The second connection is separate from the first connection, preventing the calling party from entering a live announcement. Instead, as an automated response to establishing the second connection, an audible announcement is triggered. The audible announcement identifies the availability of the call for retrieval by a particular called party. In the preferred embodiment, the access to the waiting call is restricted by either or both of verification of a password and verification that the retrieval is from one of a limited number of authorized telephones.

The preferred embodiment further includes parking the call from the calling party prior to triggering the audible announcement, thereby terminating the first connection to the voicemail system and allowing immediate access to the call by the called party. The call is parked on a known telephone line, such as a "dummy extension." The audible announcement includes identifications of both the known telephone line and the called party, i.e., the identified user. A threshold time for pickup is preselected. If the call is not retrieved prior to expiration of the threshold time, the waiting call is returned to the voicemail system.

Still referring to the preferred embodiment, the audible announcement is a first tier of a multi-tier notification scheme. The different tiers may be based upon regions. For example, the first announcement may be a localized announcement within the facility, while the second tier may be audible only within a different localized region or may be a general-facility announcement. Alternatively, the differences in the tiers of the multi-tier notification scheme may be based upon modes of paging the identified party. For example, the first mode is the public announcement system, while a backup mode may be to notify a wireless pager carried by the identified party. Alternative announcement systems are also available. As an example, one audible announcement system may include overhead speakers, while a second announcement system may use the intercom feature of a facility having speaker telephones.

As previously noted, the calling party is connected to the voicemail system prior to any connection to the announcement system. Therefore, the calling party may be presented with certain options. The calling party may select between leaving a voice message and initiating the announcement process. In one embodiment, the access to the announcement process is restricted by input of a password or by recognition that the calling party is at one of a designated number of telephones. If the multi-tier notification scheme is utilized, the transitions from one tier to the next may be strictly time-related or may be implemented at the option of the calling party, e.g., if the use of one tier fails to result in a call pickup, the unanswered call is returned to the voicemail system and the caller is presented with the option of triggering the second tier or leaving a message.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a facility having an automated integration of a switch, a voicemail system, and an announcement system in accordance with the invention.

FIG. **2** is a process flow of steps for utilizing the intersystem arrangement of FIG. **1** for providing paging capability.

FIG. **3** is a process flow of initiating the intersystem arrangement of FIG. **1**.

DETAILED DESCRIPTION

With reference to FIG. **1**, a facility **10** is shown as including a number of telephones **12**, **14** and **16**. Each telephone is connected to a switch **18** via a different station line **20**, **22** and **24**. The switch may be a PBX, but this is not critical. While not shown in FIG. **1**, the switch preferably includes "dummy extensions," i.e., extensions which are not directly tied to a telephone, allowing a call to be parked for subsequent retrieval.

A call from outside of the facility **10** is routed to the switch **18** via a central office **26**, as is well known in the art. Each of the telephones **12**, **14** and **16** is assigned to a particular user and has a unique phone number. A direct inward dialing (DID) feature of the switch **18** permits an external caller to reach a particular phone of one of the users. Thus, the called party can be identified by the phone number dialed by the calling party. This phone number is received in the calling information during the setup of the call.

Internal calls from one of the telephones **12**, **14** and **16** to another one of the telephones require only the extension number to be dialed by the calling party. Often, this is a two-digit to a five-digit number that is identical to the last several digits that must be dialed by an external caller.

An unanswered internal or external call to one of the telephones **12**, **14** and **16** may be directed to a voicemail system **28**. The forwarding of a call to a voicemail system is known in the art. The forwarding is typically an automated rerouting by the switch **18**. In addition to the switch and the voicemail system, the facility includes an announcement system **30**. The announcement system provides audible announcements via at least one speaker **32**, and is distinguishable from a wireless pager system **34**. The speaker or speakers may be overhead devices or may be contained within each one of the telephones **12**, **14** and **16**. That is, the telephones may be speaker phones. Other schemes for audibly identifying the availability of calls for pickup by particular parties may also be utilized.

In operation, intersystem cooperation is achieved without requirement of an operator. When a call is unanswered, a first connection **36** is formed between the switch **18** and the voicemail system **28** to connect the calling party with the voicemail system. In the preferred embodiment, the caller is presented with the option to either leave a voice message or initiate an announcement process. For example, the caller may be instructed to press the "1" key of a telephone keypad to select the message option, or to press the "2" key to initiate the announcement process. If the announcement option is selected, a second connection **38** is established. The second connection is illustrated as a direct connection between the voicemail system **28** and the announcement system **30**, but typically the connection is formed via the switch **18**. A prerecorded message is audibilized via the speaker or speakers **32**. The triggered prerecorded message identifies the called party and an extension at which the waiting call is parked. If the switch **18** is utilized to park the call, the first connection **36** may be terminated upon parking the call. On the other hand, if the voicemail system **28** is used to park the call, the first connection **36** remains intact. Particularly in embodiments in which the voicemail system is used to park the call, a call manager **40** is beneficial in handling calls routed to the voicemail system. Two memory modules **42** and **44** are also shown as being connected to the voicemail system. The functions of the memory modules will be described fully below.

Optionally, the wireless pager system **34** may be activated if the paged party does not pickup the waiting call within a preselected period of time. The call is again forwarded to the voicemail system **28**, which automatically establishes a connection **46** with the wireless pager system. The information required for paging the called party is transferred from the voicemail system **28** to the wireless pager system. This information may be stored at the second memory module **44**. The type of pager system is not critical to the invention. In one embodiment, radio frequency signals that are specific to one remote pager device are transmitted via an antenna **48**.

One advantage of the invention is that the automation of the call-notification operations eliminates the need of a full-time operator at the facility **10**. Another advantage is that prerecorded paging messages may be used to provide a uniform voice and format and to ensure sufficient clarity, amplitude and quality.

Another important advantage relates to security and will be described fully below. Access to the announcement procedure may be restricted by use of a password or by designating a limited number of authorized telephones. Moreover, access to calls that have been announced may be limited by requiring a password or by designating only certain phones as authorized phones for retrieving a particular parked call. The automated process allows each person who may be the object of a page to be reached within selected paging zones, with password protection.

The call-notification process will be described more fully with reference to FIG. **2**. In step **50**, announcement information is stored. Typical announcements will include the identification of a person and an extension at which a call is parked. In a hospital setting, an exemplary announcement is "Doctor Green, please pickup extension 2136." The various announcements are stored at the voicemail system **28**, but may be stored at the announcement system **30** of FIG. **1**.

In step **52**, external and internal calls directed to one of the telephones **12**, **14** and **16** are detected and routed using conventional techniques. The switch **18** is used to route the calls. PBXs allow a user of one of the telephones **12**, **14** and **16** to notify the PBX that the user will be away from the telephone, so that incoming calls are immediately routed to the voicemail system **28**. PBXs also allow the phone to ring a set number of times, but then presume that the user is unavailable. In step **54**, calls directed to an unavailable user or to a busy phone are forwarded to the voicemail system.

Conventional voicemail systems merely allow a calling party to leave a message in the voicemail box of the called party. However, the preferred embodiment of the invention is one in which the calling party is presented with options. In a personalized greeting, the called user may instruct the caller to press a certain key (e.g., "1") or sequence of keys to leave a message, or to press a different key (e.g., "2") or sequence of keys to initiate a page announcement. The decision step is shown at **56** in FIG. **2**.

In addition to recording the page announcement information at step **50** and recording the personalized greeting within the voicemail system **28**, there are other setup options and requirements. FIG. **3** illustrates some of the possible setup steps. Firstly, a paging hierarchy may be formed **58**. As previously noted, the hierarchy may be based upon area, based upon modes of paging, or both. An area-based hierarchy may have a first level in which the triggered announcement is audible on only one floor of a hospital and may have a second level in which the page announcement is broadcast on all floors of the hospital. A mode-based hierarchy for the facility **10** of FIG. **1** may utilize the announcement system **30** to broadcast the page announcement, with the wireless pager system **34** being used if the page announcement does not result in a call pickup. In the preferred embodiment, the hierarchy is determined on a user-by-user basis. That is, each user is enabled to select a desired hierarchy. However, the selection may be facility-wide. The selected hierarchy is stored in the memory module **44** of FIG. **1**.

The setup step **60** in FIG. **3** provides a first level of security. Optionally, only designated individuals are authorized to utilize the announcement system **30**. All other callers may merely leave a message at the appropriate voicemail box of the voicemail system **28**. In one embodiment, the announcement-access is enabled only if a caller inputs a password, such as a particular sequence of digits. For example, there may be a personal identification number (PIN) that is input using the keypad of a conventional telephone. As an alternative to the password-based access enablement, there may be a limitation to the telephones that may be used to trigger a page announcement. As one example, automated access to the announcement system may be restricted to calls initiated from one internal telephone **12**, **14** and **16** to another one of the internal telephones. In another example, caller identification information received as a result of an incoming external call may be used as a basis to determine announcement-access. That is, the announcement-access parameters set in step **60** may be a designation of certain external telephones to which access is to be restricted. Similar to step **58**, the parameters of step **60** may be individualized or may be facility-wide. The settings are stored in the memory module **42** of FIG. **1**.

In step **62**, connectivity-security parameters are set. These parameters may be used to limit the access to a waiting call. Privacy and/or security interests may dictate limitations on the availability of call pickup. As an example, a caller may not recognize a doctor by voice, so that any person within a hospital could attempt to pose as a paged doctor and ask personal questions. The connectivity-security parameters set in step **62** may require a person attempting to retrieve a call to enter a password (e.g., a PIN) before the parties are connected. In another embodiment, these retrieval limitations are related to designating certain internal phones **12**, **14** and **16** as authorized phones. A particular user may designate a telephone in a backup office of the user as the only authorized phone for retrieving calls that are the subjects of page announcements identifying the user. The retrieval limitations are preferably selected on a user-by-user basis. The parameters are stored in the memory module **42** of FIG. **1**.

The automated announcement capability is then initiated at step **64**. As will be explained more fully below, the system monitors available extensions for parking the calls that are the subjects of page announcements. Step **66** is included to identify the process of maintaining the extension table.

Returning to FIG. **2**, the decision step **56** is determined at a first level by the announcement-access parameters selected in step **60** of FIG. **3** and stored in the memory module **42** of FIG. **1**. At a second level, the calling party selects between recording a message and triggering a broadcast of a page announcement. Step **68** of recording a message is implemented using conventional techniques of voicemail systems. On the other hand, if the calling party is authorized and elects the announcement option, the relevant page parameters are determined at step **70**. The selected paging hierarchy of the memory module **44** may dictate that the page announcement is to be made only within a localized region. In some embodiments, the calling party is presented with options relating to the area in which the page announcement is to be broadcast.

The voicemail system **28** then parks the call at step **72**. A limited number of "dummy extensions" may be configured in the switch **18**. Each of the dummy extensions is capable of holding a waiting call. The voicemail system may implement this step by sending a park command to the switch **18**. As an example, the park command may be PARK **2136**, where PARK is the system PARK command or button and where **2136** is one of the dummy extensions. In order for the voicemail system to monitor the extensions, the extensions must be preconfigured within the voicemail system. As noted with reference to step **66** in FIG. **3**, the voicemail system may use an extension table to track the hold-and-retrieval process. While the call is parked at a dummy extension, the caller will hear ring-back tone or on-hold music, depending upon the configuration of the switch **18**.

The voicemail system **28** is then able to release the line, since the call is parked on the dummy extension. The voicemail system then goes off-hook on an available channel/port to form the second connection **38** between the voicemail system **28** and the announcement system **30**. This intersystem connectivity is shown at step **74** in FIG. **2**. While the connectivity is illustrated as a direct connection in FIG. **1**, typically the connectivity requires the operation of the switch **18**. The off-hook condition of the available channel/port relates to a connection to the switch **18**. The voicemail system dials P, where P is the system paging access command. This may be controlled by the call manager **40**. The call manager then causes the appropriate announcement information to be played, e.g., "Doctor Green, please pickup extension 2136." The announcement is shown at step **76** in FIG. **2**. The interconnection between the voicemail system **28** and the announcement system **30** may then be terminated.

Extension 2136 is marked in the extension table as being occupied by the waiting call. The next caller requesting an announcement may be parked at dummy extension 2137, until all of the available dummy extensions are utilized. If no dummy extension is available for a call, the voicemail system can transfer the next caller to an available operator.

In step **78**, the time required for a paged party to retrieve a call is monitored. Preferably, a recall time is established by configuring the voicemail system **28** or the switch **18**. If during the decision step **80** the parked call is retrieved, any relevant access parameters are checked at step **82**. This includes enforcing the connectivity-security parameters set at step **62** in FIG. **3**. The security check is intended to preserve the privacy of the calling party and/or to reduce the susceptibility of the intersystem process to unauthorized dissemination of information. Provided that the person attempting to retrieve the call is authorized, the parties are connected at step **84**.

The voicemail system **28** preferably includes a parameter that defines a wait-time between parking calls on an individual dummy extension. Immediately after a call is parked on the extension, the voicemail system starts the timer. After the time expires, the voicemail system assumes that the extension is again available for a parked call. This parameter should be a few seconds longer than the recall time described with reference to the step **78** of timing the call retrieval.

The call retrieval time relevant to steps **78** and **80** is configured in the switch **18** as the maximum time that a call remains parked on an extension before a recall is initiated. In the embodiment of FIG. **2**, if the call is not retrieved before expiration of the designated time, the call is again forwarded to the voicemail system at step **54**. The voicemail system typically receives some identifying information in the signaling channel, if one exists (e.g., an ISDN environment). At the least, caller identification information is forwarded to the voicemail system with an indication that the call is a returning one from the PARK condition. As a result, the voicemail system plays the appropriate prompt, such as "Doctor Green did not answer the page." In the preferred embodiment, the prompt also includes options. The caller may again be presented with the option of recording a message at step **68**. In a multi-tier scheme, the caller may be presented with the option of implementing a second tier of call notification. As previously noted, the second tier may be a difference with respect to the area in which an audible announcement is broadcast, or may be a switch to a different system. In FIG. **1**, the call manager **40** may initiate the connection **46** to activate the remote pager of the called party. While the connection **46** is shown as the direct connection between the voicemail system **28** and the wireless pager system **34**, typically the interaction between the two systems is achieved utilizing the switch **18**. For example, the voicemail system may go off-hook on an available channel/port to the switch **18** and dial the appropriate access command for activating the wireless pager system. Some wireless pager systems allow the display of numeric codes on the remote pager devices. In such an embodiment, the voicemail system may be used to outpulse the required dual tone multi-frequency (DTMF) tones to notify the user that he or she can call in and pickup the parked call. Pagers that include alphanumeric displays are contacted by the voicemail system using the appropriate protocol for the particular system.

Remote pager devices may play short voice messages. In such a situation, the voicemail system **28** of FIG. **1** may contact the pager system **34** and play the same message that was sent to the announcement system **30** for broadcast. A special external pickup feature may be implemented in the switch **18** to allow a user to call in from an external phone in order to retrieve the parked call. As an alternative, the paged external caller may contact an operator at the facility **10** and request that the operator establish the connectivity between the parties.

In embodiments that include the multi-tier notification scheme, the appropriate sequence of steps that follow the decision step **56** in FIG. **2** are followed a second time. Thus, the parked call is either retrieved prior to the expiration of the time limit of step **78** and the parties are connected at step **84**, or the call is returned to the voicemail system from the decision step **80**. If all of the tiers are implemented without success, the calling party is informed that the only remaining option is recording a message at step **68**.

As an alternative to the embodiment described above, the unanswered call may be parked logically or physically in the voicemail system **28**. The user who is paged would then access the call by logging onto the voicemail system. As another alternative to the arrangement described above, the central office **26** of FIG. **1** may perform the functions of the switch **18**. That is, an on-site switch is not critical.

While the invention has been described and illustrated as including a "parking lot" of dummy extensions, this is not critical. Switches having built-in parking areas are known, so that there is no need for the preconfiguration of dummy extensions. A system parking area is sometimes referred to as a system park, a system orbit, or an array of system spaces.

What is claimed is:

1. A method of utilizing an announcement system to provide paging capability for calls forwarded to a voicemail system of a facility having a plurality of telephones, each

telephone being associated with a particular user, said method comprising steps of:

directing a call received at said facility to a specific telephone associated with an identified user, said call being intended for said identified user;

transferring said call to said voicemail system as an automated response to determining that said specific telephone has not been answered within a predetermined time interval, including establishing a first connection between said voicemail system and a telephone of a calling party, said voicemail system being capable of storing a voice message from said calling party for subsequent retrieval by said identified user;

as a first step establishing a second connection between said voicemail system and said announcement system, said second connection being separate from said first connection; and

parking said call on a known telephone line to terminate the first connection;

establishing a second connection between said voicemail system and said announcement system, said second connection being separate from said first connection; and

as an automated response to establishing said second connection, triggering an audible announcement of availability of said call for pickup by said identified user;

wherein the audible announcement is capable of verbally identifying said known telephone line and said identified user;

wherein at least one of the steps of triggering said audible announcement and establishing connectivity is selectively implemented to restrict access to either or both of triggering said areawide audible announcement and said pickup of parked call at said telephone line; and

as a second and following steps triggering said audible announcements in tiers of a multi-tier call-notification scheme in which differences in tiers are based upon at least one of regions of said facility in which said audible announcement is broadcast and modes for identifying said identified user.

2. The method of claim **1** further comprising a step of selecting a threshold time for pickup of said call by said identified user following said audible announcement, wherein said call is returned to said voicemail system for recording a voice message from said calling party upon expiration of said threshold time.

3. The method of claim **1** further comprising a step of routing said call such that said call is accessible by said identified user via a third connection, wherein establishing said third connection includes imposing at least one access restriction.

4. The method of claim **3** wherein said step that includes imposing said at least one access restriction further includes requiring input of a predetermined password prior to establishing said third connection.

5. The method of claim **3** wherein said step that includes imposing said at least one access restriction further includes storing identifications of a limited number of said telephones through which calls to said identified user can be accessed.

6. The method of claim **1** wherein said step of establishing said second connection is executed selectively to accommodate restrictive access to said announcement system based upon identification of said calling party.

7. The method of claim **6** wherein said step of accommodating restrictive access includes requiring said calling party to input a password as a condition to establishing said second connection.

8. The method of claim **6** wherein said step of accommodating restrictive access includes storing caller identification information indicative of selected telephones and further includes comparing said stored caller identification information to call data received in establishing said first connection, said call data being indicative of said telephone of said calling party.

9. A call-notification method for a facility having a plurality of telephones and an announcement system; with each telephone being associated with a particular user, said method comprising steps of:

determining a presence of a call directed to a first telephone that is associated with a first user;

presenting options to a calling party of said call to record a voicemail message or to trigger an audible announcement, said options being presented when said call is unanswered at said first telephone;

parking said call;

in response to selection of said option to trigger said audible announcement, as a first step triggering an areawide audible announcement on the said announcement system that verbally identifies said first user as having an available call; and

establishing connectivity of said call to one of said telephones in response to pickup of said parked call; and

as a second and following steps triggering said audible announcements in tiers of a multi-tier call-notification scheme in which differences in tiers are based upon at least one of regions of said facility in which said audible announcement is broadcast and modes for identifying said identified user;

wherein at least one of steps of presenting said option to trigger said audible announcement and establishing connectivity is selectively implemented to restrict access to either or both of triggering said areawide audible announcement and said pickup of said parked call.

10. The method of claim **9** wherein said step of presenting said options includes connecting said call to a voicemail system and providing a voicemail prompt that presents said options.

11. The method of claim **9** wherein said selective implementation includes storing a password for each user such that there is a one-to-one correspondence between passwords and said users.

12. The method of claim **9** wherein said selective implementation includes storing identifications of a limited number of telephones to which said access is extended.

13. An intersystem arrangement for a facility having a plurality of telephones comprising:

a switch for handling connections for calls directed to and from said telephones;

a voicemail system connected to said switch to receive calls which are unanswered at telephones to which said calls are directed, said voicemail system having established voice prompts, including a first voice prompt indicative of an option to trigger an areawide audible announcement of a called party, park the said received call at a known telephone line on the said switch, said voice prompts including a second voice prompt indicative of an option to record a message form a caller;

an announcement system responsive to a selection of said option of said first voice prompt, said announcement

system being connected to speaker means for audibilizing said areawide audible announcement that verbally identifies said known telephone line and identified user in a multi-tier call-notification scheme in which differences in tiers are based upon at least one of regions of said facility in which said audible announcement is broadcast and modes for identifying said identified user; and

security means for restricting access to call announcement and pickup capability provided by interconnection of said voicemail system with said switch and said announcement system.

14. The intersystem arrangement of claim **13** wherein said security means includes memory containing passwords having a one-to-one correspondence with authorized users.

15. The intersystem arrangement of claim **13** wherein said security means includes memory containing identifications of telephones for which said access is authorized.

16. The intersystem arrangement of claim **13** wherein said security means relates to restricting access to retrieval of calls which are unanswered and which are identified in one of said areawide audible announcements.

* * * * *

Appendix B: Evidence Appendix

Tab 3 - *Baffes*

US006292792B1

(12) **United States Patent**
Baffes et al.

(10) **Patent No.: US 6,292,792 B1**
(45) **Date of Patent: Sep. 18, 2001**

(54) **SYSTEM AND METHOD FOR DYNAMIC KNOWLEDGE GENERATION AND DISTRIBUTION**

(75) Inventors: **Paul T. Baffes; Siddarth Subramanian**, both of Austin, TX (US); **Shane V. Nugent**, Barrington, IL (US)

(73) Assignee: **Intelligent Learning Systems, Inc.**, Austin, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/277,861**

(22) Filed: **Mar. 26, 1999**

(51) **Int. Cl.**[7] **G06F 15/18**
(52) **U.S. Cl.** **706/45**
(58) **Field of Search** 706/45, 46; 434/350; 707/513; 345/333–339, 356

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Primary Examiner—Kakali Chaki
(74) *Attorney, Agent, or Firm*—Gray Cary Ware and Freidenrich

(57) **ABSTRACT**

A system and method that includes the use of a knowledge delivery computer program stored in computer-readable form on a tangible storage medium for delivering concepts from a configuration data base to a user. An author can create the configuration data base using the knowledge delivery computer program so that the configuration includes a plurality of concepts and, optionally, a plurality of problems associated with the concepts. As the author creates the concepts within the configuration, the knowledge delivery software allows the author to create a taxonomy that defines the relationships between the concepts. The knowledge delivery software can then automatically generate a pedagogy for the configuration based on the configuration taxonomy that defines how the concepts will be delivered to the user. The knowledge delivery software can facilitate the delivery of the content within the configuration to a user according to the pedagogy.

80 Claims, 35 Drawing Sheets

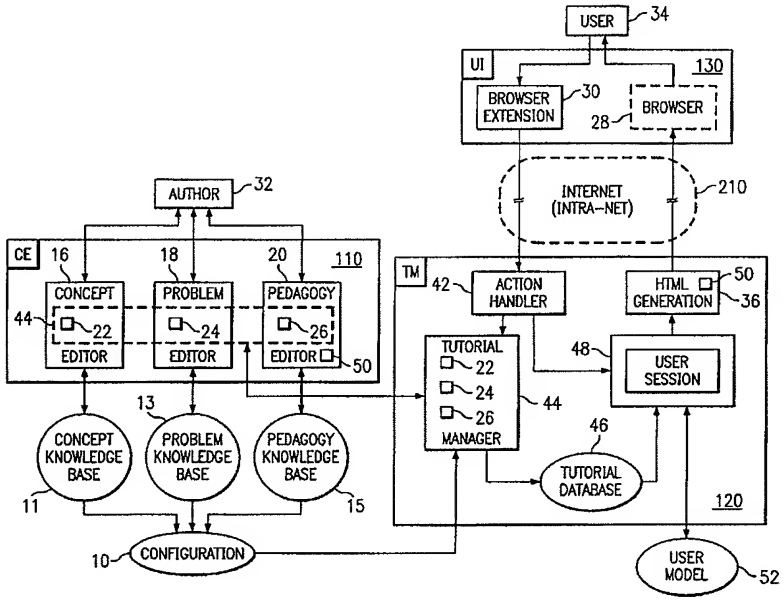
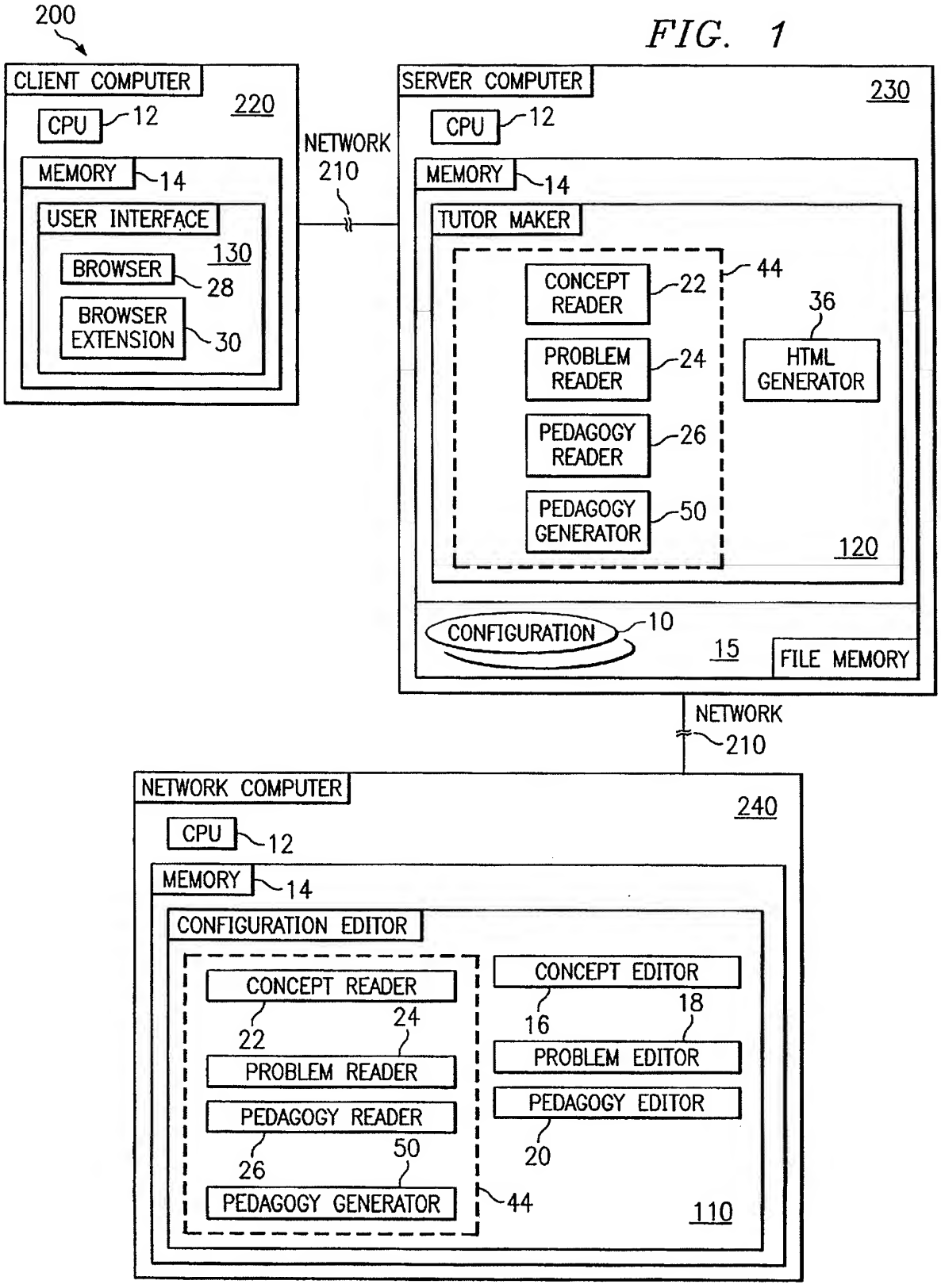


FIG. 1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BROWSER EXTENSION
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230
CPU
12
MEMORY
14
TUTOR MAKER
44
CONCEPT READER
22
PROBLEM READER
24
PEDAGOGY READER
26
PEDAGOGY GENERATOR
50
36
HTML GENERATOR
120
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15
FILE MEMORY
NETWORK
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NETWORK COMPUTER
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CONFIGURATION EDITOR
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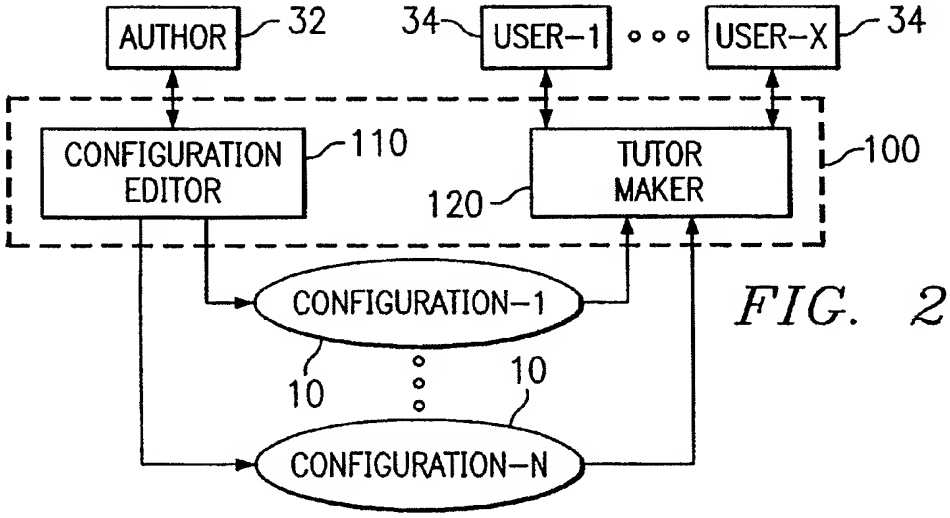
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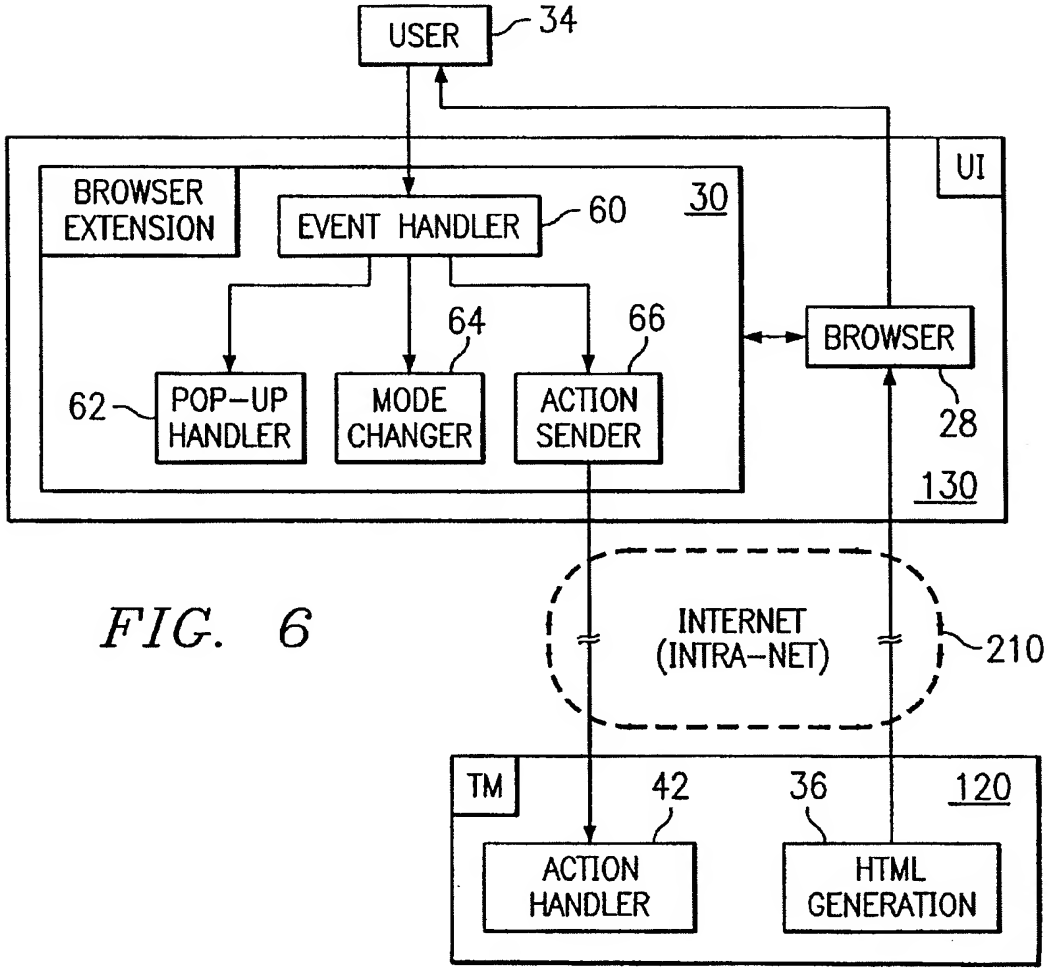
FIG. 2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EVENT HANDLER
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POP-UP HANDLER
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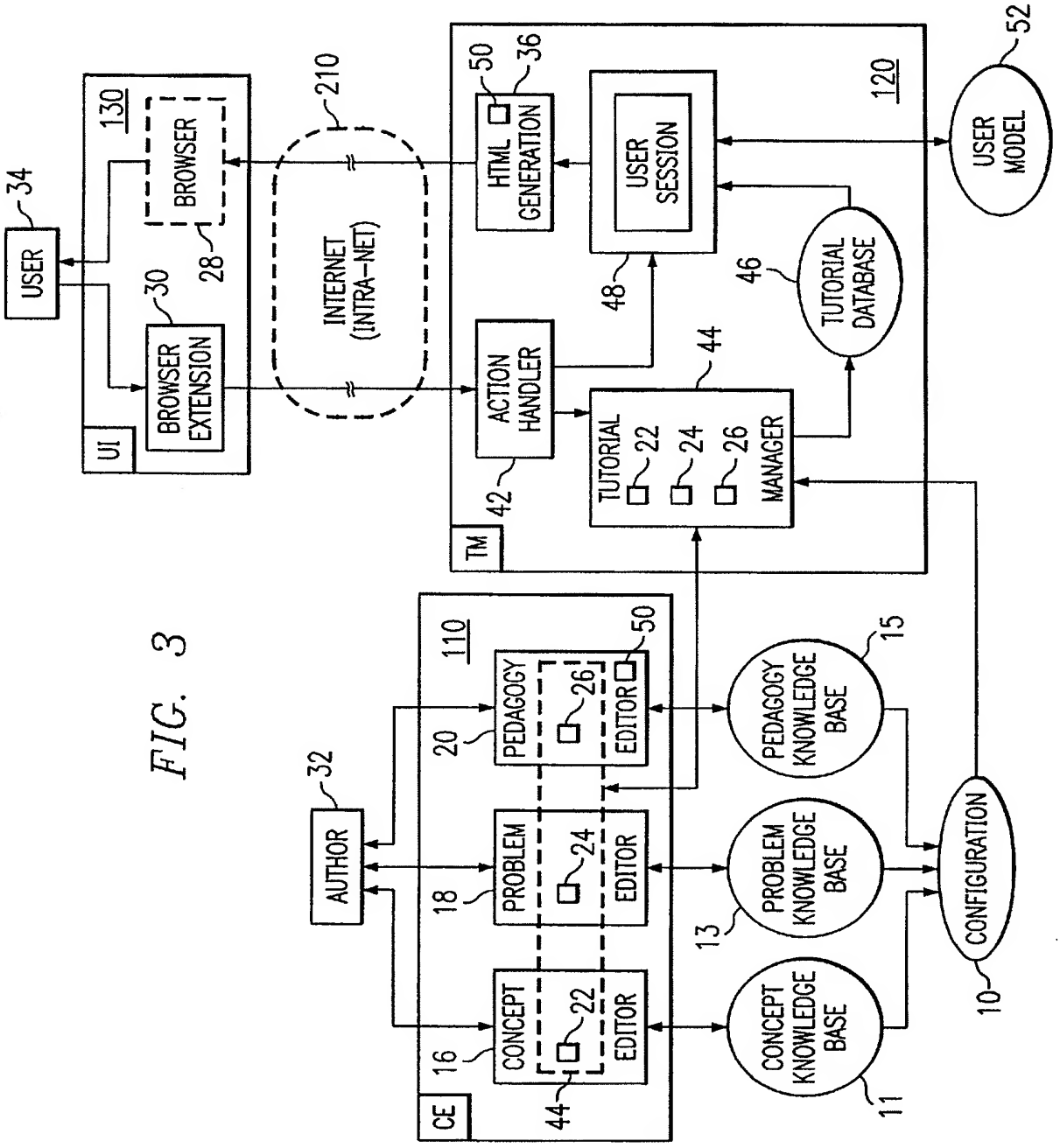
HTML GENERATION

FIG. 6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44
TUTORIAL DATABASE
46
TM
AUTHOR
32
110
PEDAGOGY
20
26
EDITOR
50
PROBLEM
18
24
EDITOR
CONCEPT
16
22
EDITOR
44
CE
PEDAGOGY KNOWLEDGE BASE
15
PROBLEM KNOWLEDGE BASE
13
CONCEPT KNOWLEDGE BASE
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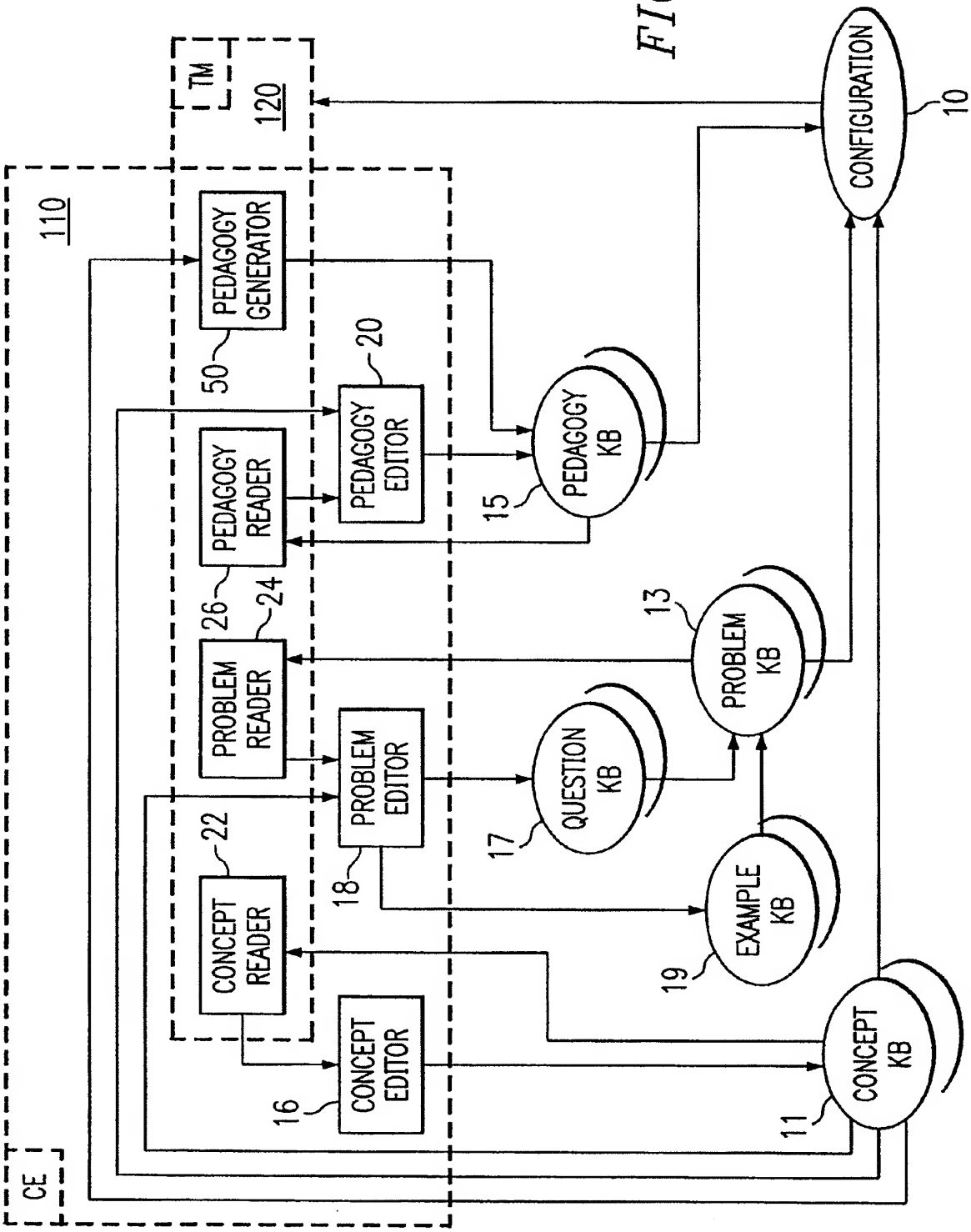
CONFIGURATION
10

FIG. 3

FIG. 4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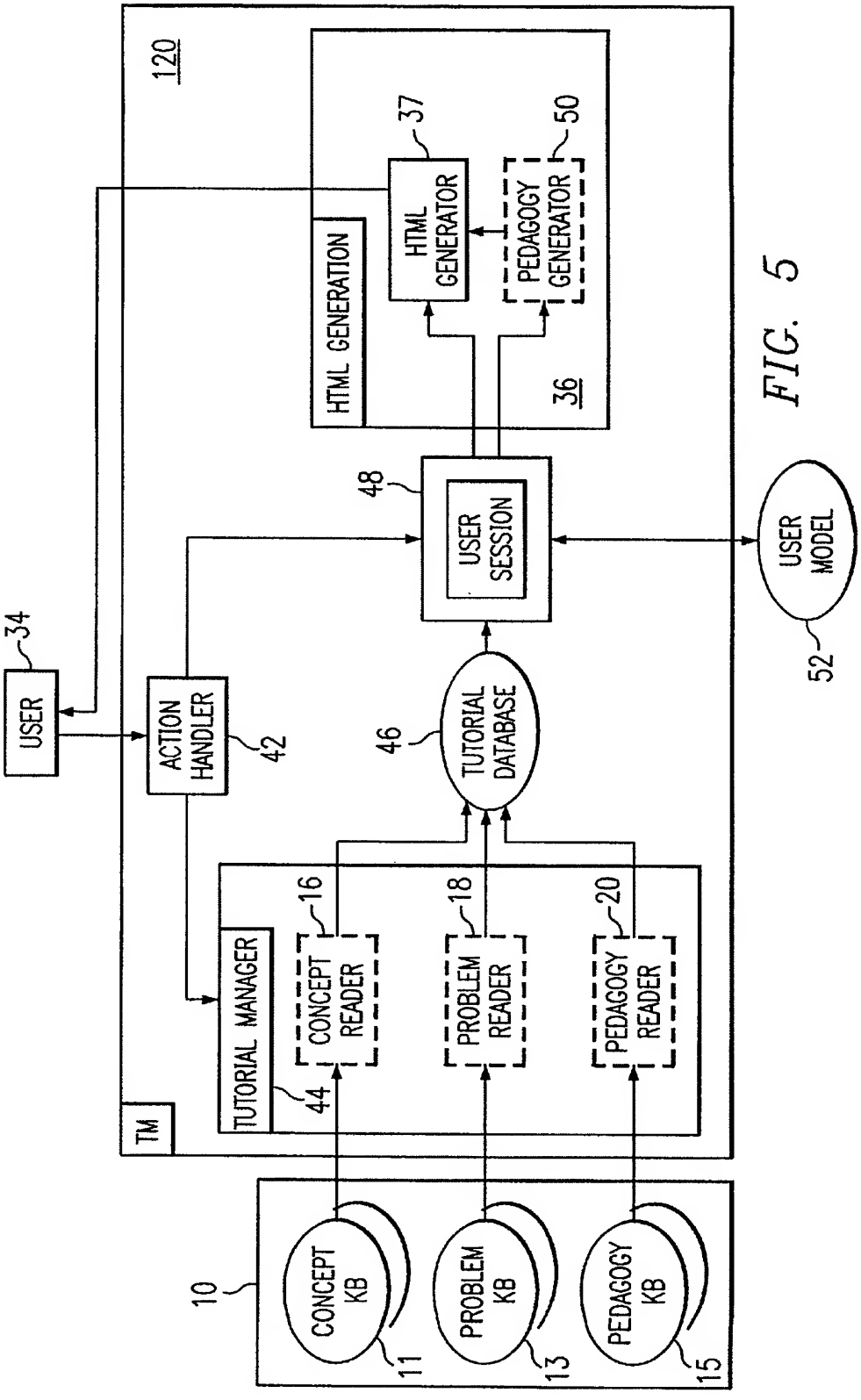
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TUTORIAL DATABASE
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TUTORIAL MANAGER
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CONCEPT READER
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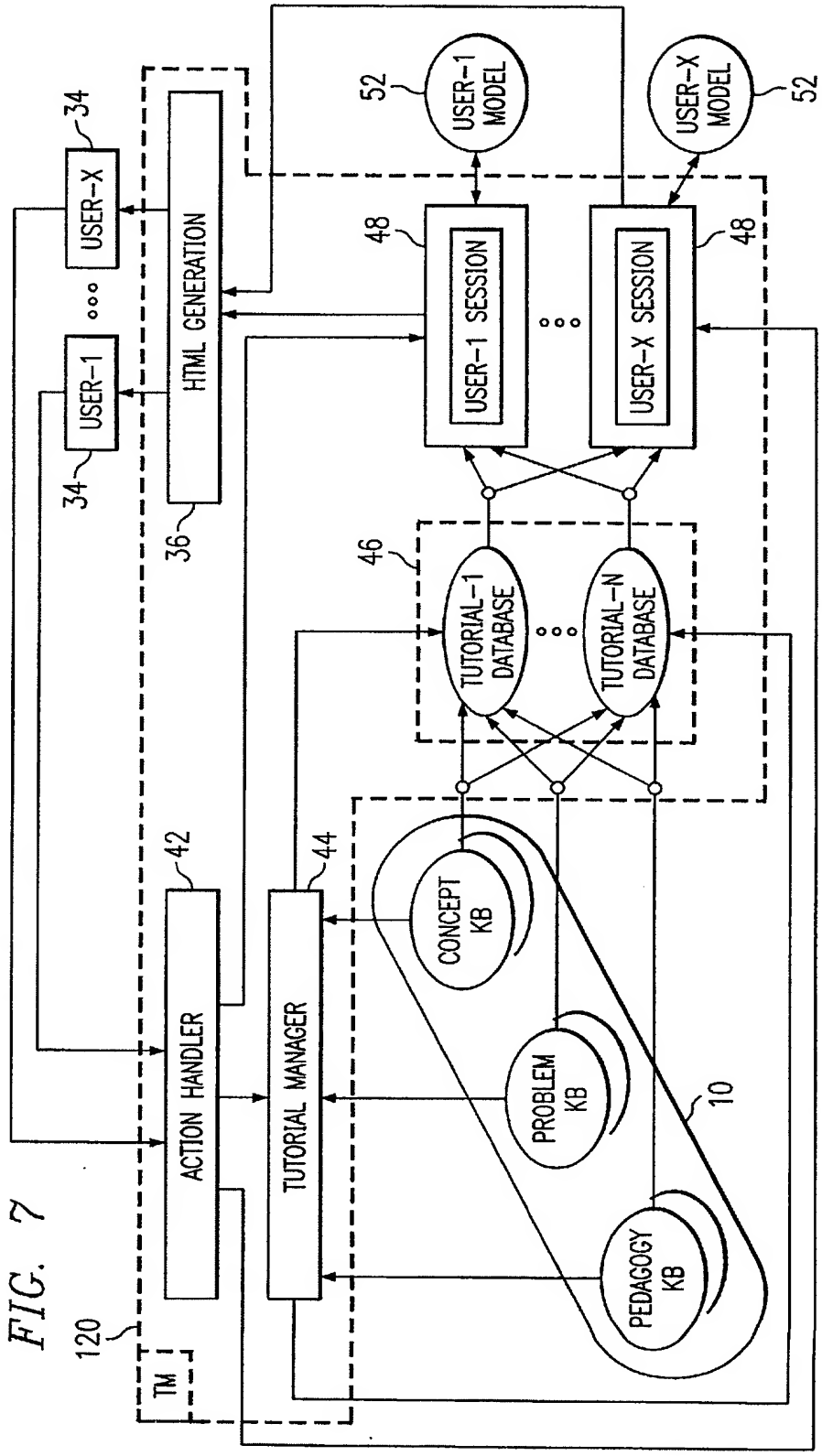
FIG. 5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TUTORIAL-N DATABASE
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FIG. 7

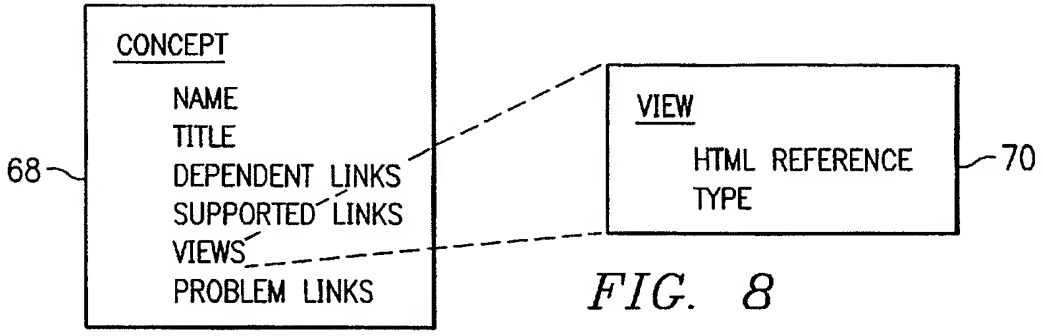


FIG. 8

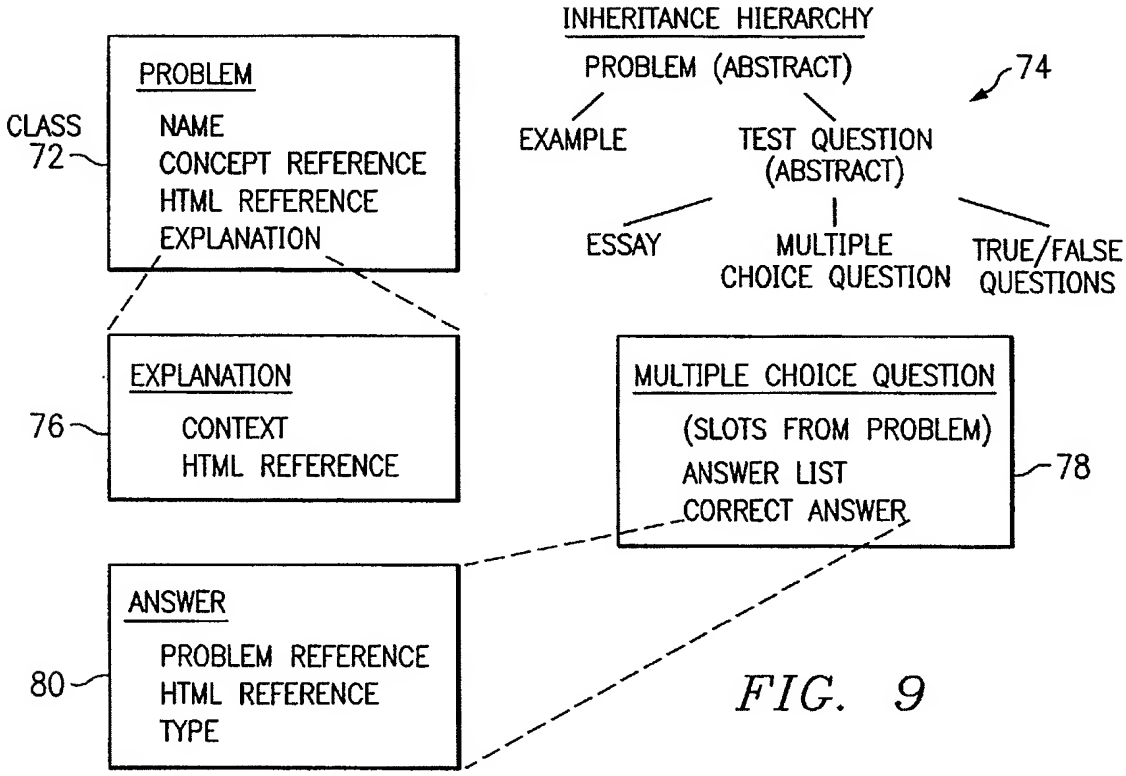


FIG. 9

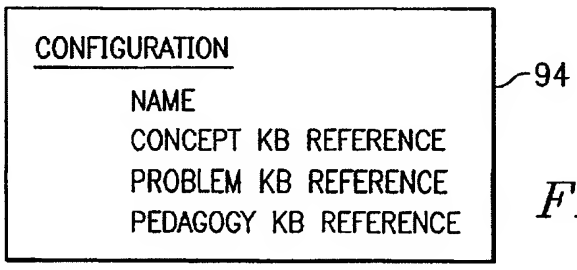


FIG. 11

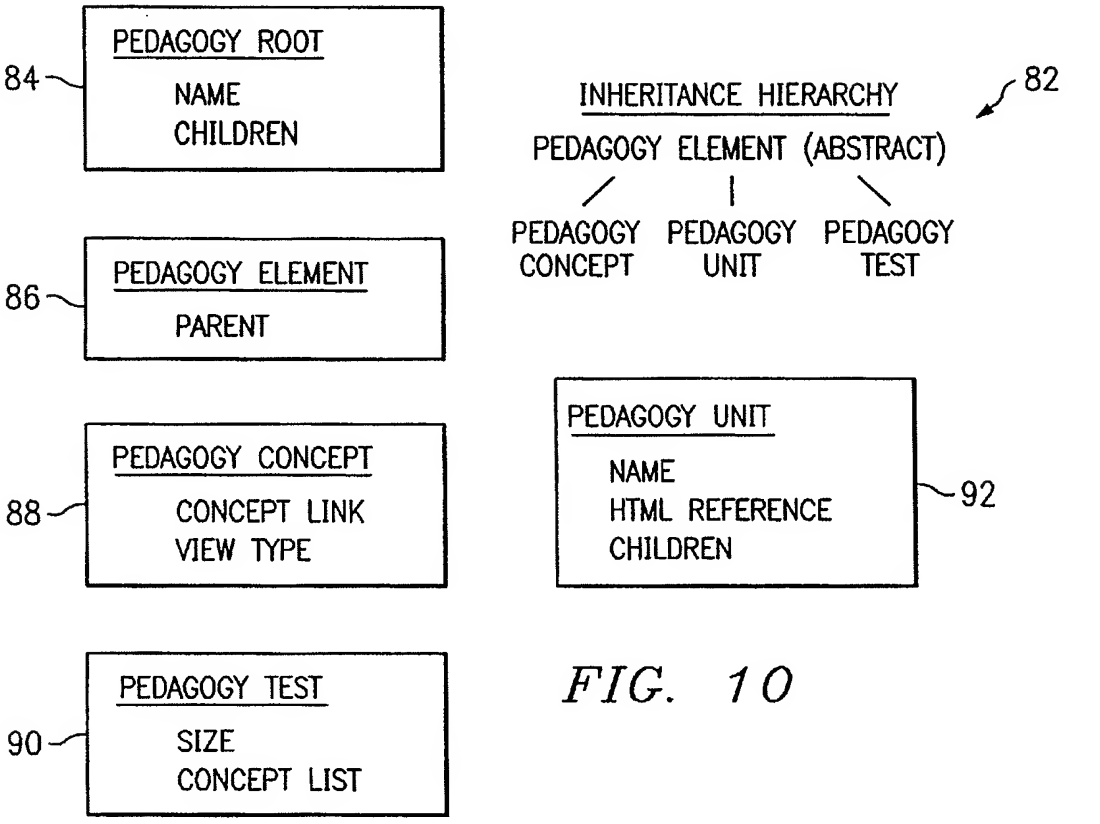

PEDAGOGY ROOT
NAME
CHILDREN
84
INHERITANCE HIERARCHY
82
PEDAGOGY ELEMENT (ABSTRACT)
PEDAGOGY CONCEPT
PEDAGOGY UNIT
PEDAGOGY TEST
PEDAGOGY ELEMENT
PARENT
86
PEDAGOGY UNIT
NAME
HTML REFERENCE
CHILDREN
92
PEDAGOGY CONCEPT
CONCEPT LINK
VIEW TYPE
88
PEDAGOGY TEST
SIZE
CONCEPT LIST
90

FIG. 10

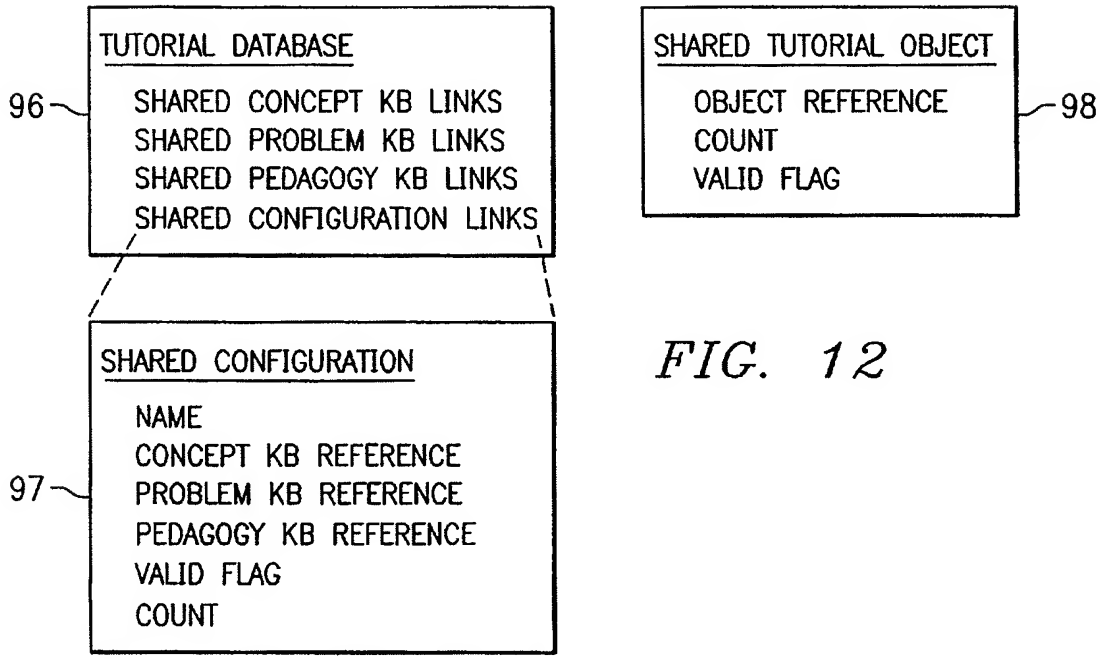

TUTORIAL DATABASE
SHARED CONCEPT KB LINKS
SHARED PROBLEM KB LINKS
SHARED PEDAGOGY KB LINKS
SHARED CONFIGURATION LINKS
96
SHARED TUTORIAL OBJECT
OBJECT REFERENCE
COUNT
VALID FLAG
98
SHARED CONFIGURATION
NAME
CONCEPT KB REFERENCE
PROBLEM KB REFERENCE
PEDAGOGY KB REFERENCE
VALID FLAG
COUNT
97

FIG. 12

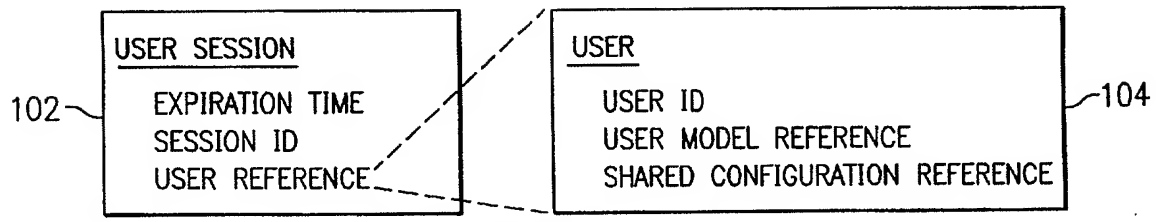


FIG. 13

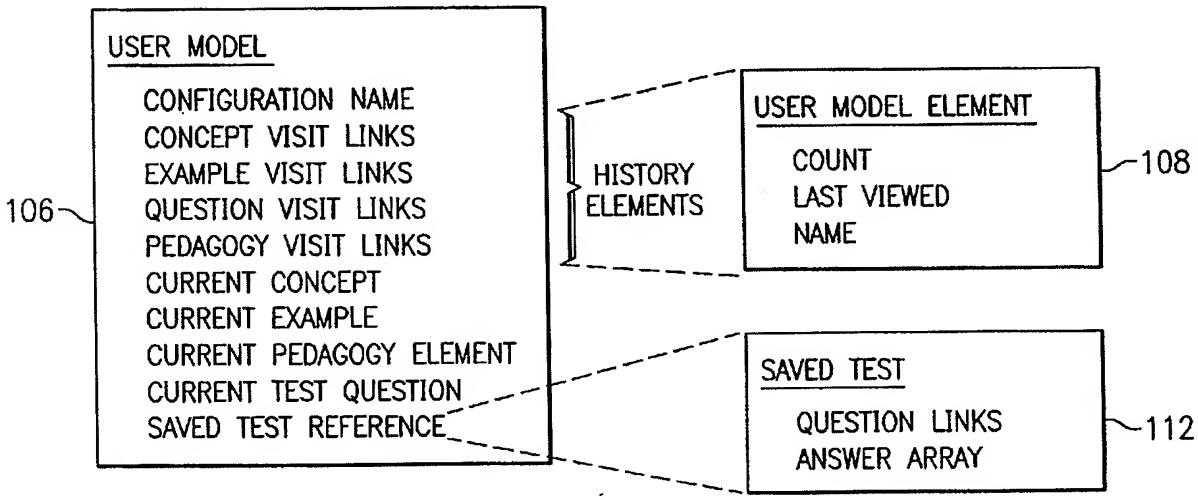


FIG. 14

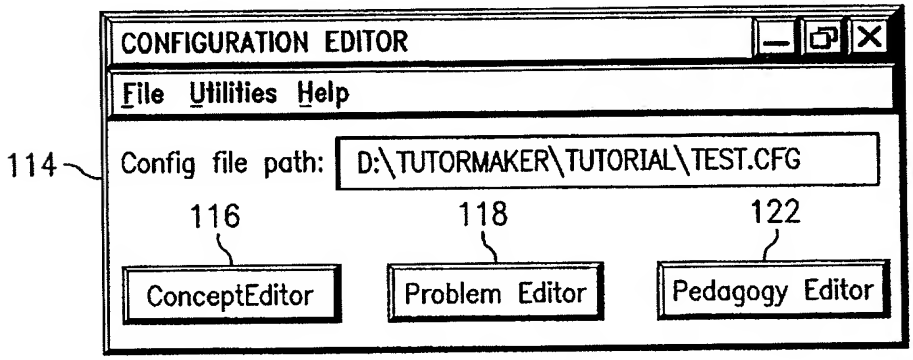


FIG. 15

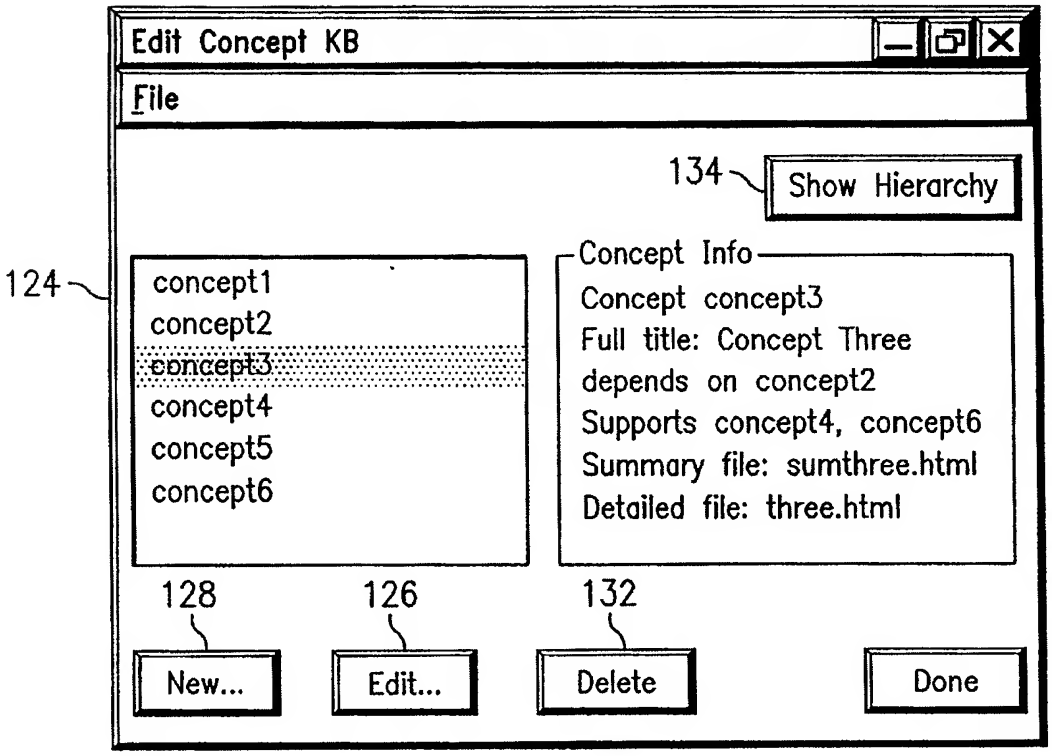

Edit Concept KB
File
134
Show Hierarchy
124
concept1
concept2
concept3
concept4
concept5
concept6
Concept Info
Concept concept3
Full title: Concept Three
depends on concept2
Supports concept4, concept6
Summary file: sumthree.html
Detailed file: three.html
128
126
132
New...
Edit...
Delete
Done

FIG. 16

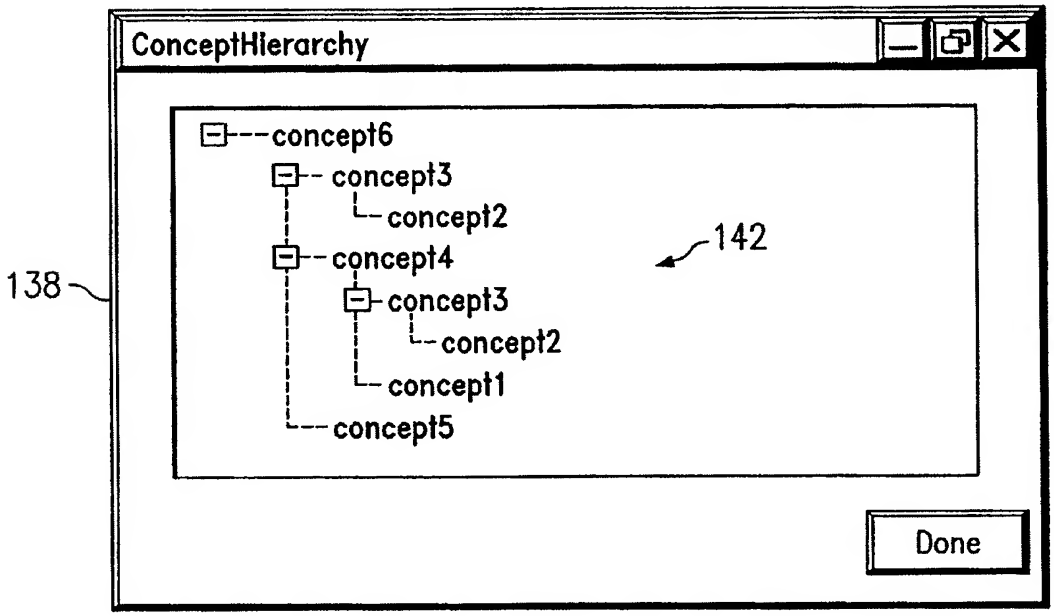

ConceptHierarchy
138
concept6
concept3
concept2
concept4
concept3
concept2
concept1
concept5
142
Done

FIG. 18

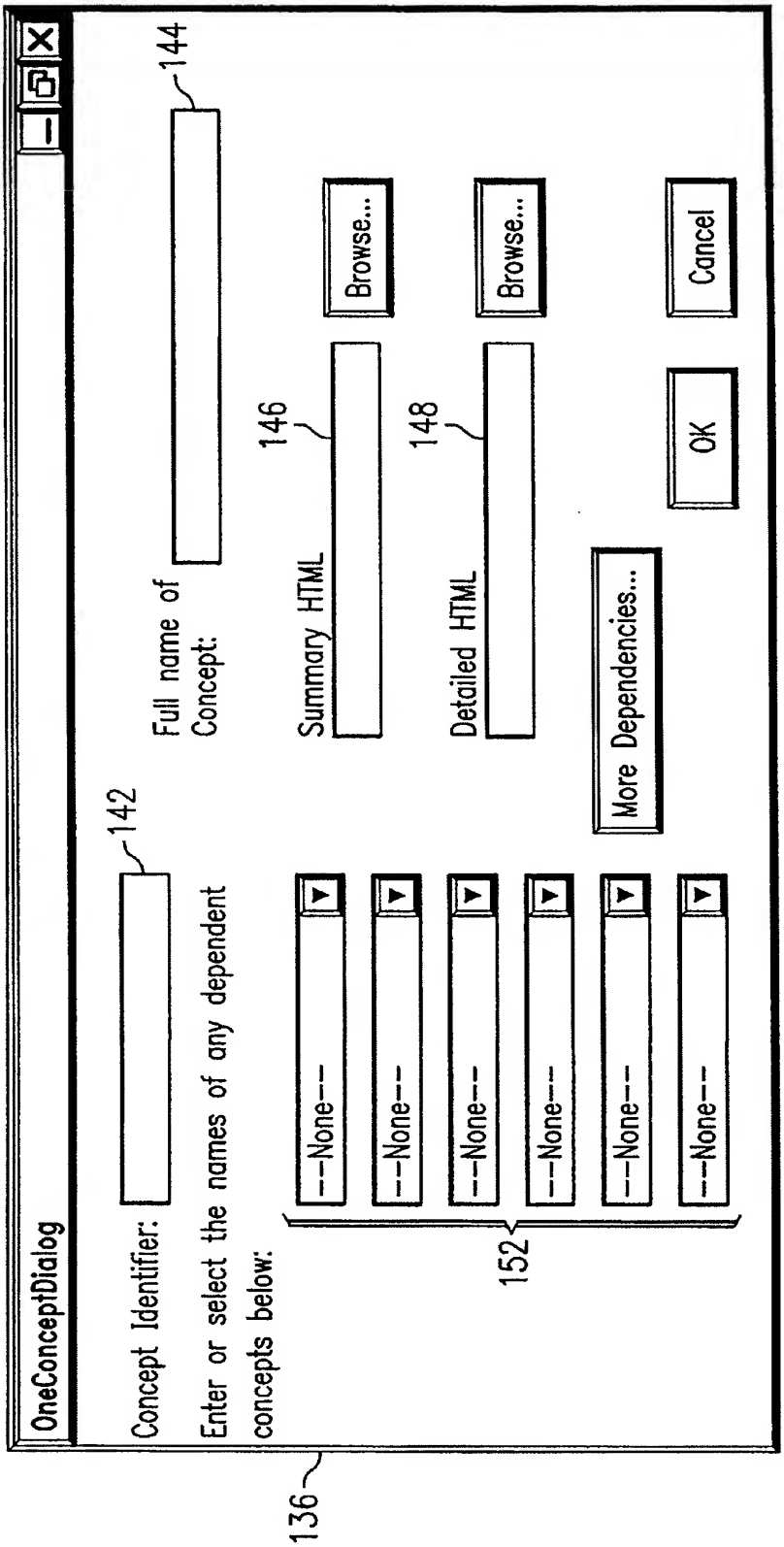

OneConceptDialog
Concept Identifier:
142
Enter or select the names of any dependent concepts below:
Full name of Concept:
144
Summary HTML
146
Detailed HTML
148
Browse...
Browse...
More Dependencies...
OK
Cancel
--None--
--None--
--None--
--None--
--None--
--None--
152
136

FIG. 17

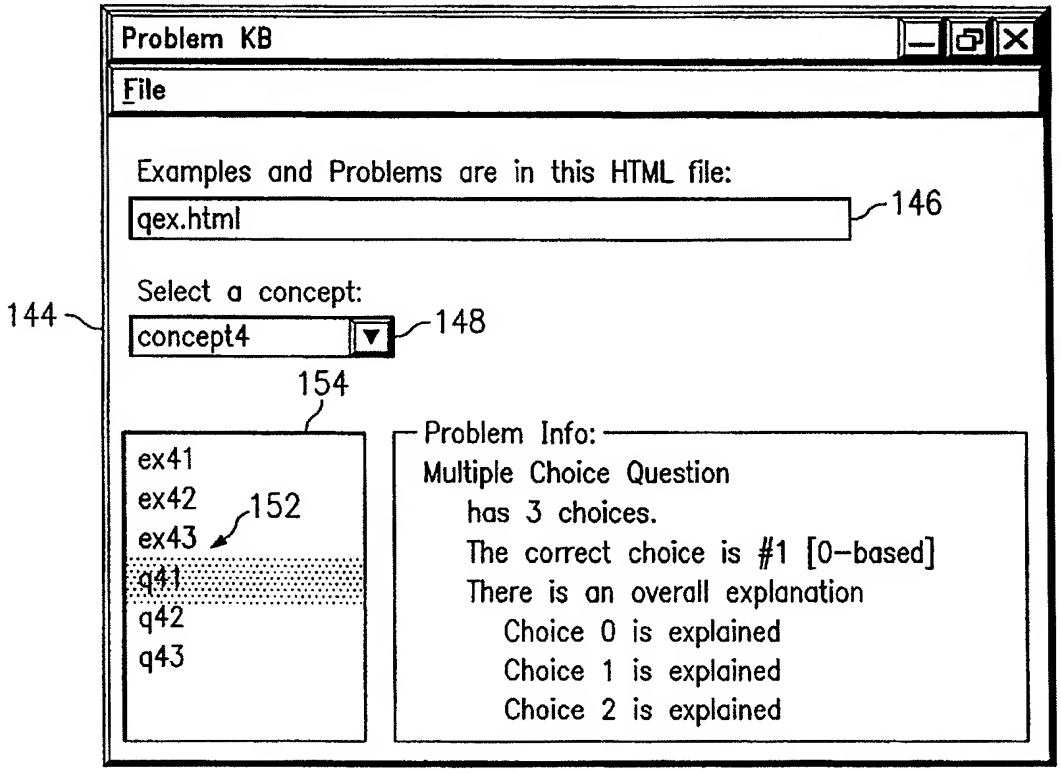

Problem KB
File
Examples and Problems are in this HTML file:
qex.html
146
Select a concept:
144
concept4
148
154
ex41
ex42
ex43
152
q41
q42
q43
Problem Info:
Multiple Choice Question
has 3 choices.
The correct choice is #1 [0-based]
There is an overall explanation
Choice 0 is explained
Choice 1 is explained
Choice 2 is explained

FIG. 19

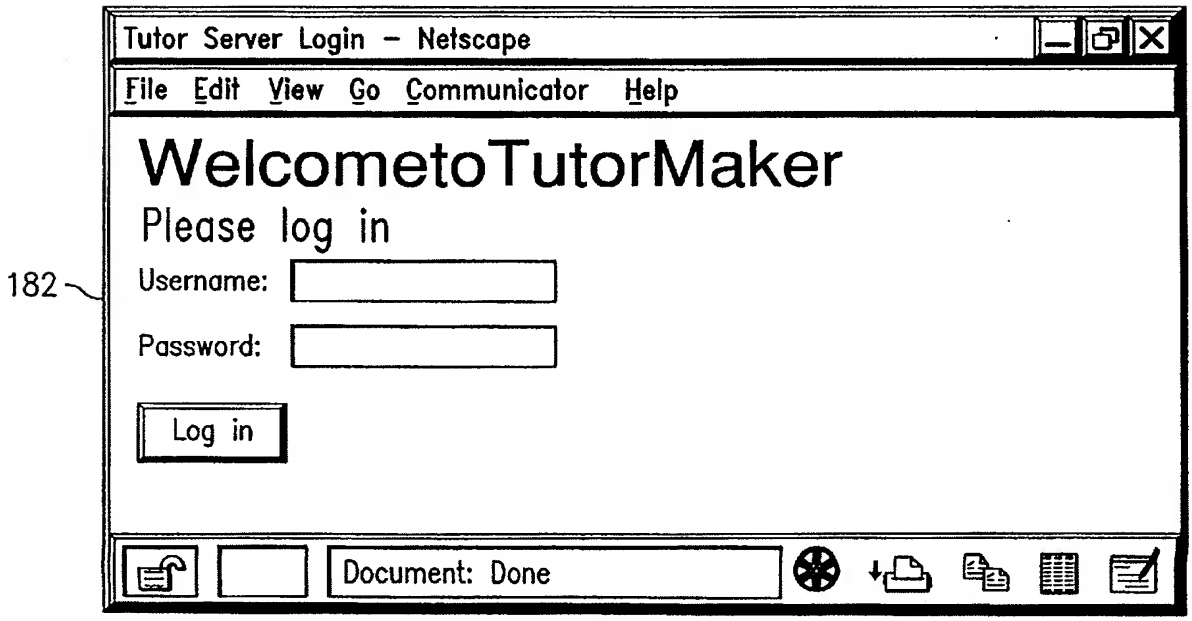

Tutor Server Login - Netscape
File Edit View Go Communicator Help
WelcometoTutorMaker
Please log in
182
Username:
Password:
Log in
Document: Done

FIG. 22

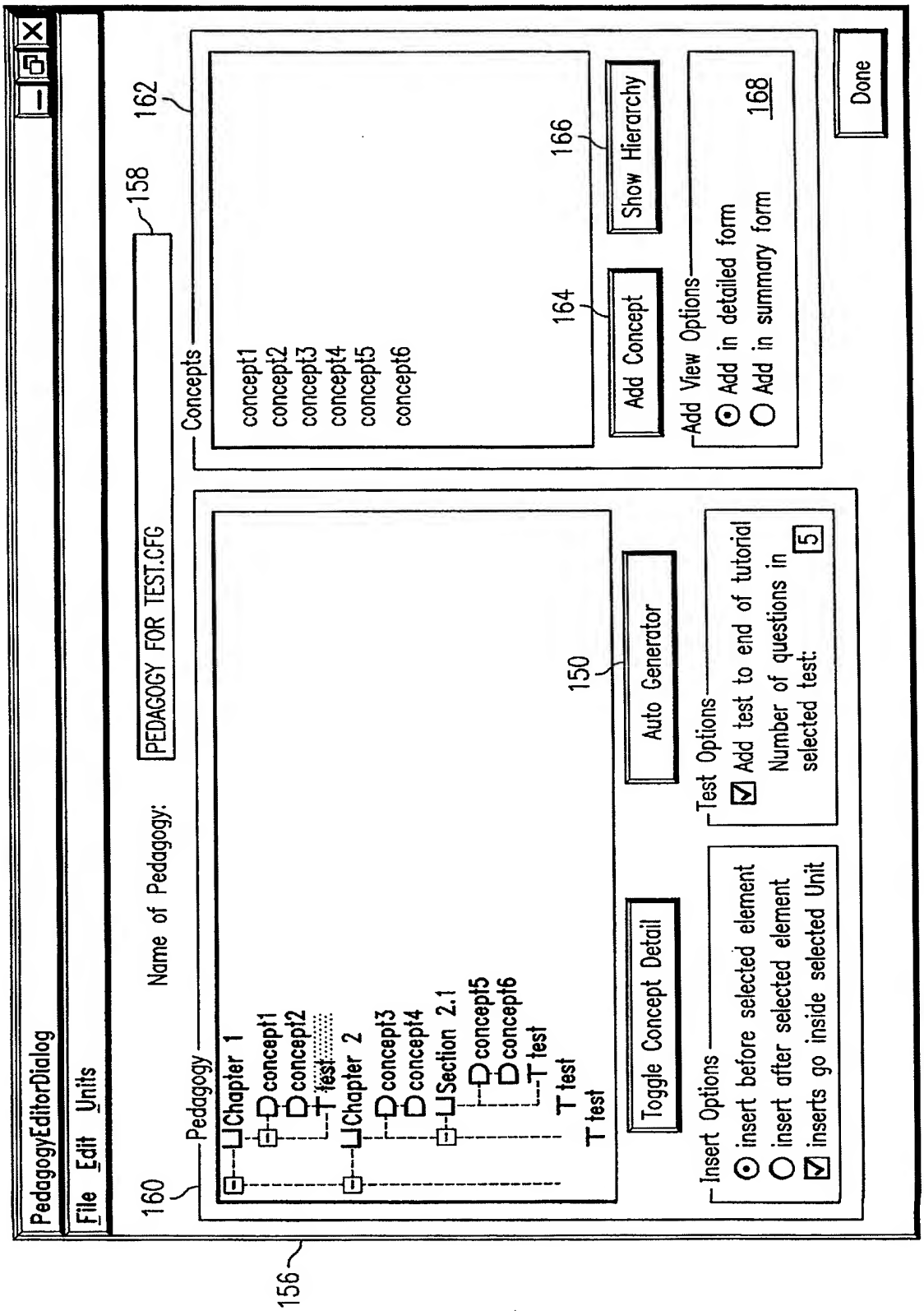

PedagogyEditorDialog
File Edit Units
Name of Pedagogy:
PEDAGOGY FOR TEST.CFG
158
162
Concepts
concept1
concept2
concept3
concept4
concept5
concept6
166
164
Add Concept
Show Hierarchy
Add View Options
Add in detailed form
Add in summary form
168
Done
160
Pedagogy
Chapter 1
concept1
concept2
test
Chapter 2
concept3
concept4
Section 2.1
concept5
concept6
test
test
test
150
Auto Generator
Toggle Concept Detail
Insert Options
insert before selected element
insert after selected element
inserts go inside selected Unit
Test Options
Add test to end of tutorial
Number of questions in selected test:
5
156

FIG. 20

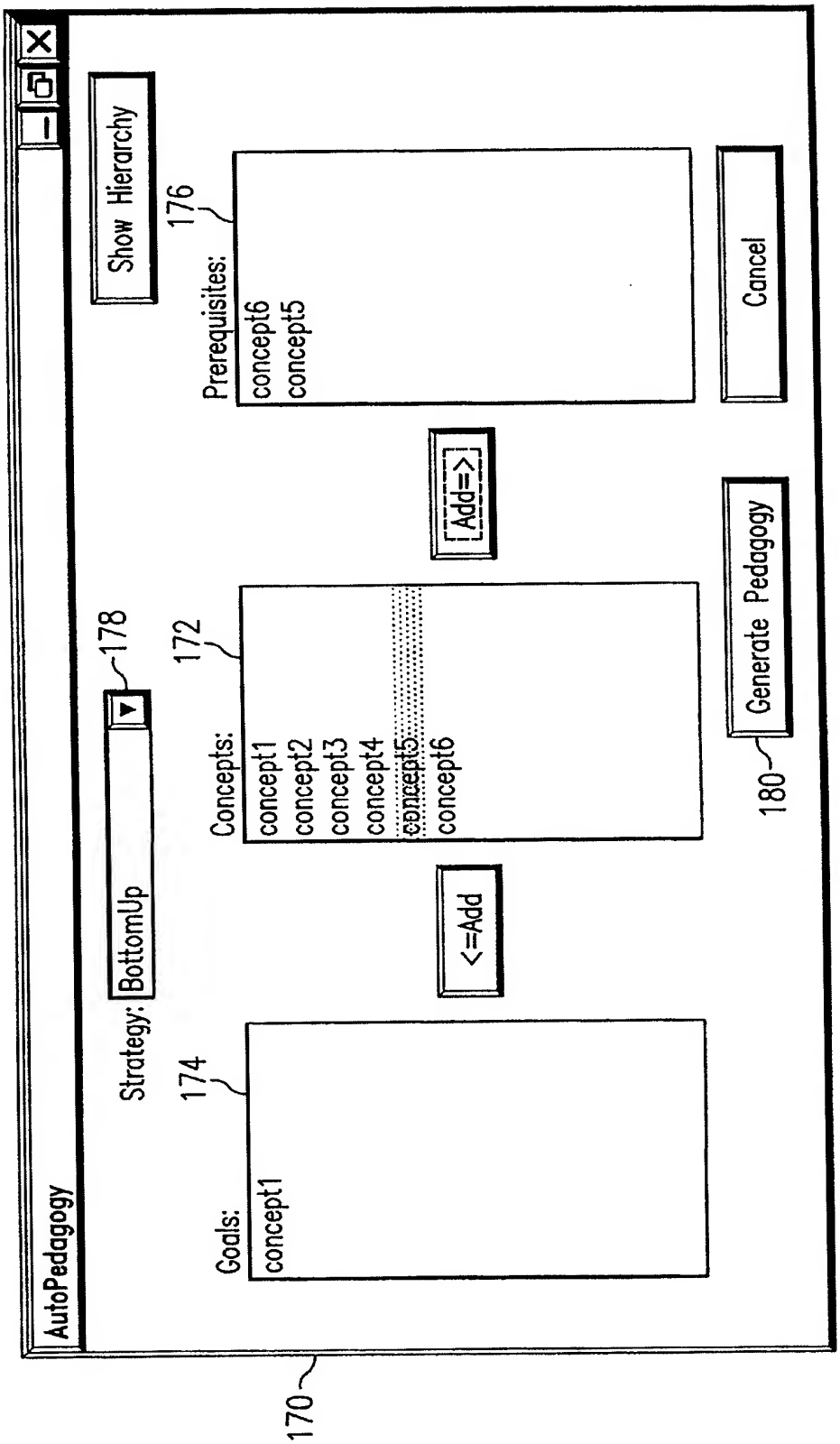

AutoPedagogy
Show Hierarchy
176
Prerequisites:
concept6
concept5
Cancel
Add=>
178
172
Concepts:
concept1
concept2
concept3
concept4
concept5
concept6
Strategy:
BottomUp
<=Add
Generate Pedagogy
180
174
Goals:
concept1
170

FIG. 21

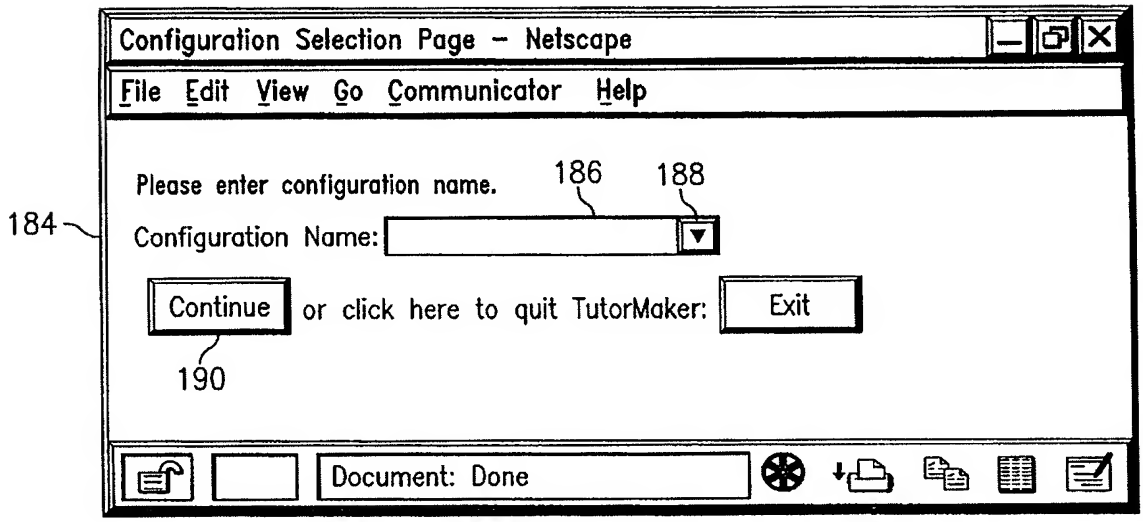

Configuration Selection Page - Netscape
File Edit View Go Communicator Help
Please enter configuration name.
186
188
184
Configuration Name:
Continue
or click here to quit TutorMaker:
Exit
190
Document: Done

FIG. 23

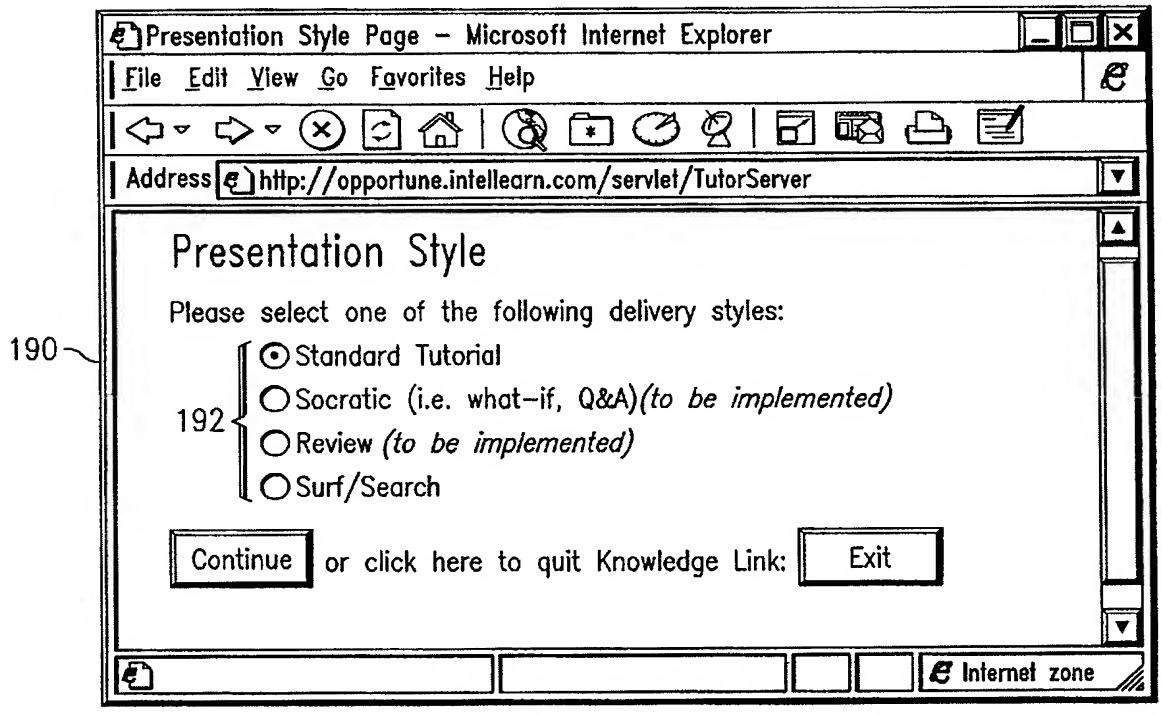

Presentation Style Page - Microsoft Internet Explorer
File Edit View Go Favorites Help
Address http://opportune.intellearn.com/servlet/TutorServer
Presentation Style
Please select one of the following delivery styles:
190
192
Standard Tutorial
Socratic (i.e. what-if, Q&A)(to be implemented)
Review (to be implemented)
Surf/Search
Continue
or click here to quit Knowledge Link:
Exit
Internet zone

FIG. 24

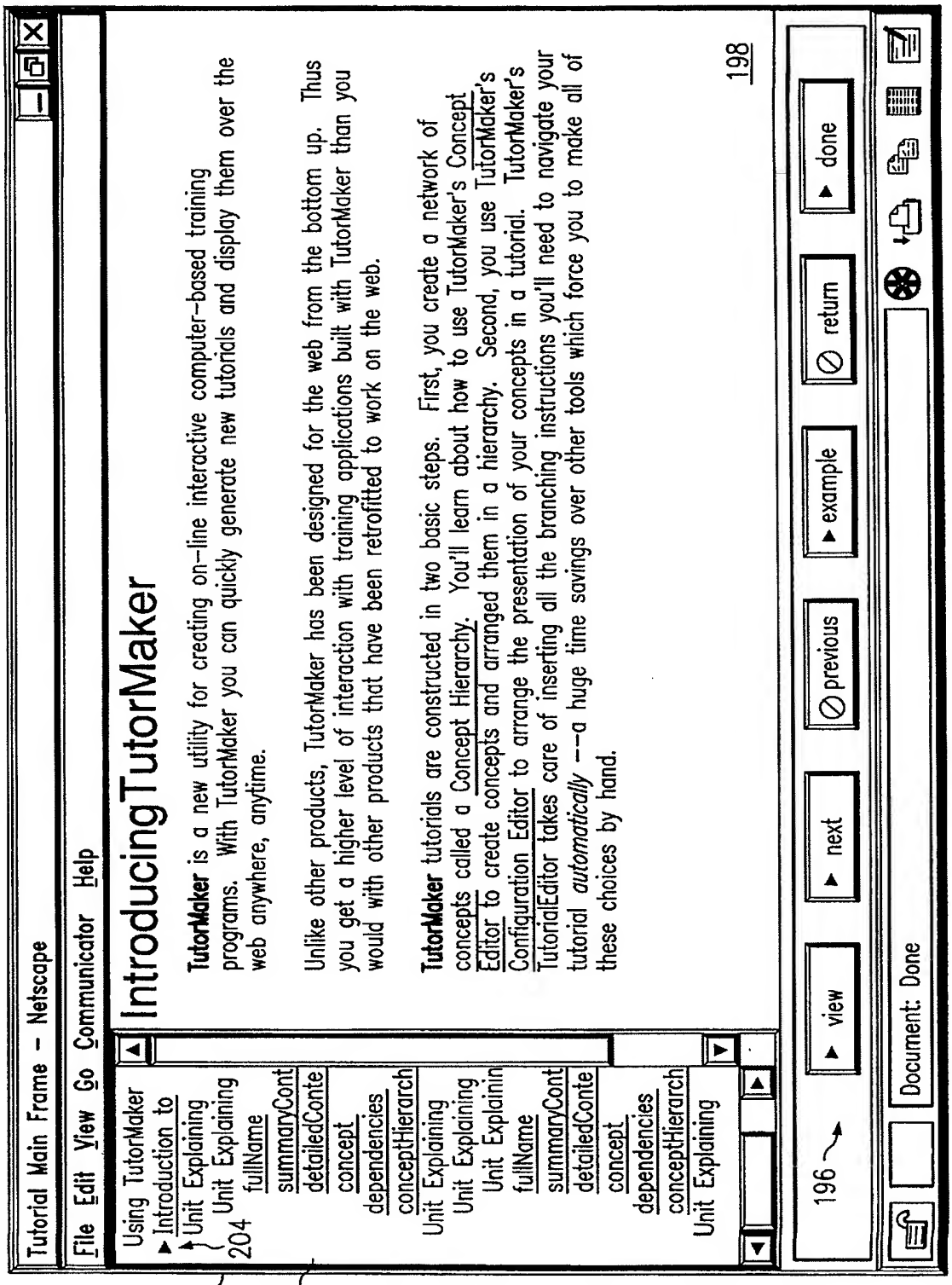
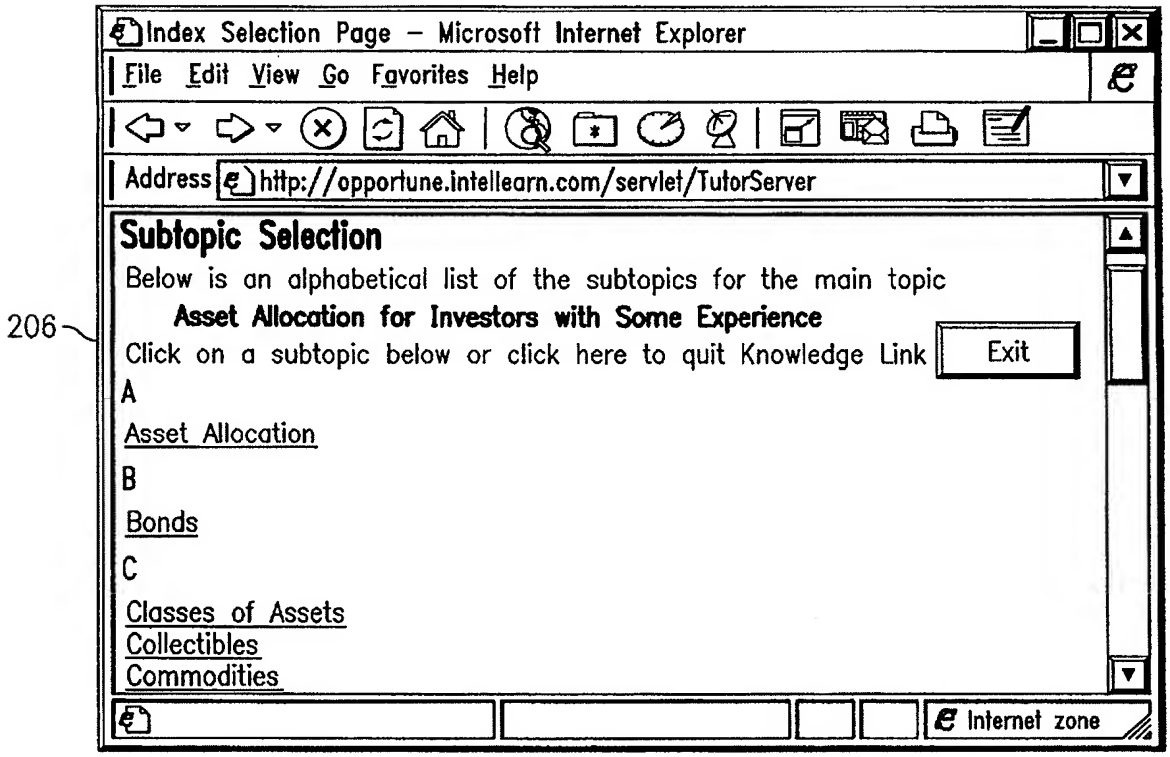

Tutorial Main Frame – Netscape
File Edit View Go Communicator Help
Using TutorMaker
Introduction to
Unit Explaining
Unit Explaining
fullName
summaryCont
detailedConte
concept
dependencies
conceptHierarch
Unit Explaining
Unit Explaining
Unit Explainin
fullName
summaryCont
detailedConte
concept
dependencies
conceptHierarch
Unit Explaining
IntroducingTutorMaker
TutorMaker is a new utility for creating on-line interactive computer-based training programs. With TutorMaker you can quickly generate new tutorials and display them over the web anywhere, anytime.
Unlike other products, TutorMaker has been designed for the web from the bottom up. Thus you get a higher level of interaction with training applications built with TutorMaker than you would with other products that have been retrofitted to work on the web.
TutorMaker tutorials are constructed in two basic steps. First, you create a network of concepts called a Concept Hierarchy. You'll learn about how to use TutorMaker's Concept Editor to create concepts and arranged them in a hierarchy. Second, you use TutorMaker's Configuration Editor to arrange the presentation of your concepts in a tutorial. TutorMaker's TutorialEditor takes care of inserting all the branching instructions you'll need to navigate your tutorial automatically --a huge time savings over other tools which force you to make all of these choices by hand.
198
196
view
next
previous
example
return
done
Document: Done
194
202
204

FIG. 25

FIG. 26


Index Selection Page – Microsoft Internet Explorer
File Edit View Go Favorites Help
Address http://opportune.intellearn.com/servlet/TutorServer
Subtopic Selection
Below is an alphabetical list of the subtopics for the main topic
Asset Allocation for Investors with Some Experience
Click on a subtopic below or click here to quit Knowledge Link
Exit
A
Asset Allocation
B
Bonds
C
Classes of Assets
Collectibles
Commodities
Internet zone
206

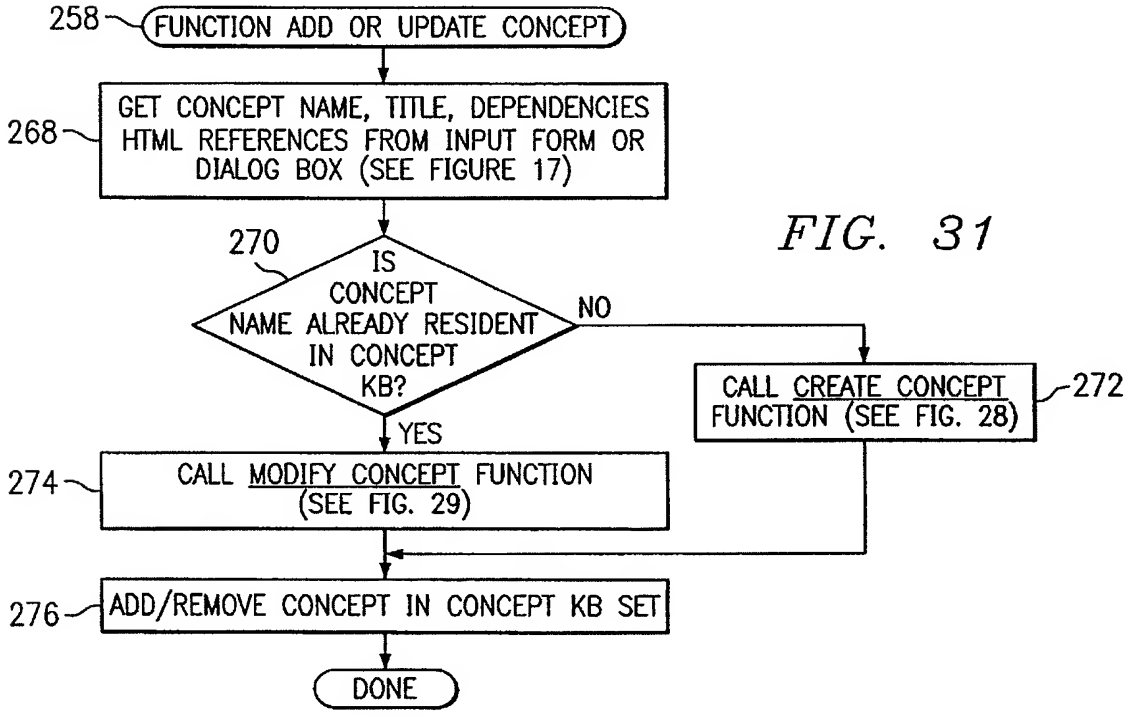

258
FUNCTION ADD OR UPDATE CONCEPT
268
GET CONCEPT NAME, TITLE, DEPENDENCIES HTML REFERENCES FROM INPUT FORM OR DIALOG BOX (SEE FIGURE 17)
270
IS CONCEPT NAME ALREADY RESIDENT IN CONCEPT KB?
NO
YES
CALL CREATE CONCEPT FUNCTION (SEE FIG. 28)
272
274
CALL MODIFY CONCEPT FUNCTION (SEE FIG. 29)
276
ADD/REMOVE CONCEPT IN CONCEPT KB SET
DONE

FIG. 31

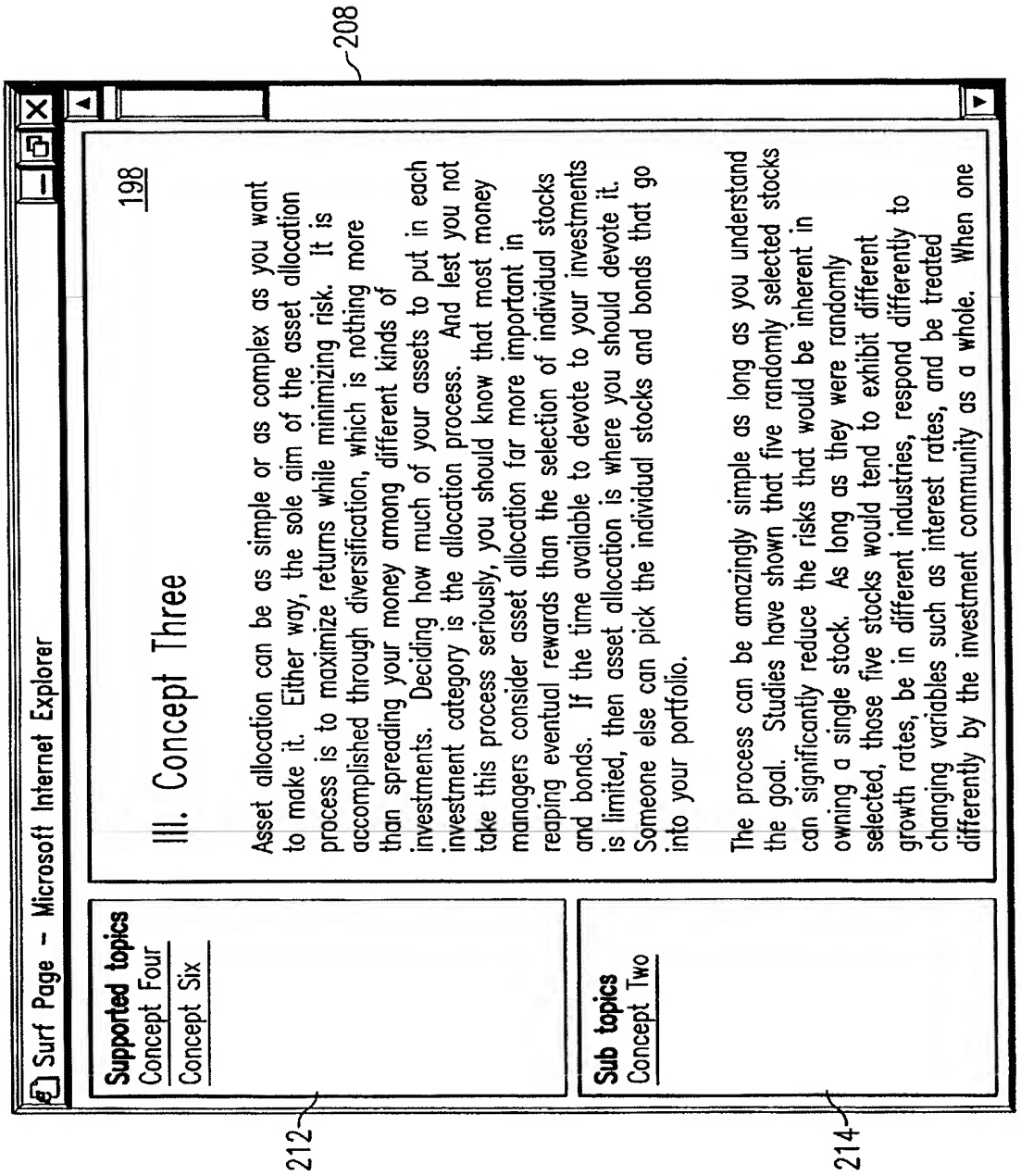

Surf Page - Microsoft Internet Explorer
Supported topics
Concept Four
Concept Six
Sub topics
Concept Two
198
III. Concept Three
Asset allocation can be as simple or as complex as you want to make it. Either way, the sole aim of the asset allocation process is to maximize returns while minimizing risk. It is accomplished through diversification, which is nothing more than spreading your money among different kinds of investments. Deciding how much of your assets to put in each investment category is the allocation process. And lest you not take this process seriously, you should know that most money managers consider asset allocation far more important in reaping eventual rewards than the selection of individual stocks and bonds. If the time available to devote to your investments is limited, then asset allocation is where you should devote it. Someone else can pick the individual stocks and bonds that go into your portfolio.
The process can be amazingly simple as long as you understand the goal. Studies have shown that five randomly selected stocks can significantly reduce the risks that would be inherent in owning a single stock. As long as they were randomly selected, those five stocks would tend to exhibit different growth rates, be in different industries, respond differently to changing variables such as interest rates, and be treated differently by the investment community as a whole. When one
208
212
214

FIG. 27

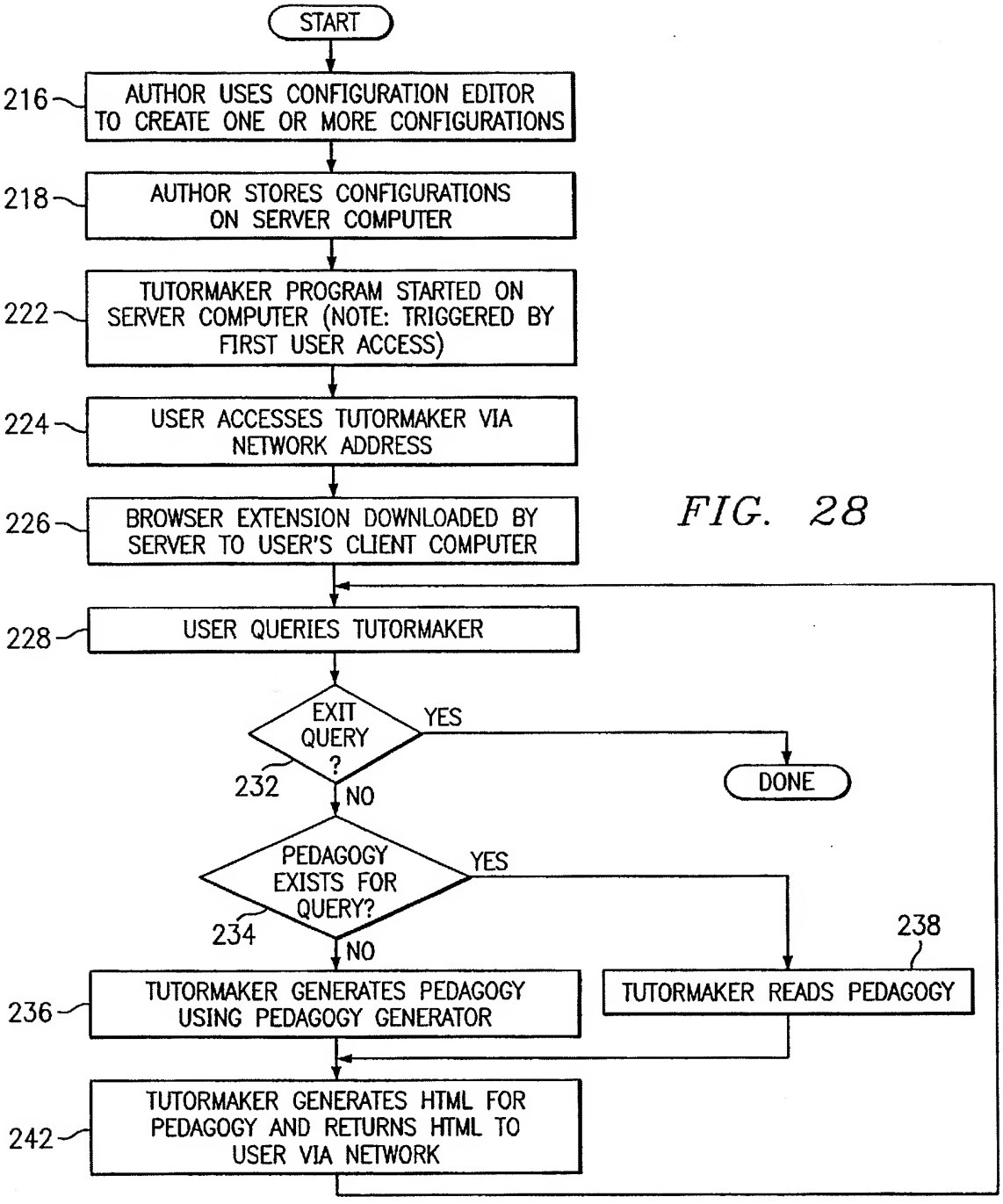

START
216
AUTHOR USES CONFIGURATION EDITOR TO CREATE ONE OR MORE CONFIGURATIONS
218
AUTHOR STORES CONFIGURATIONS ON SERVER COMPUTER
222
TUTORMAKER PROGRAM STARTED ON SERVER COMPUTER (NOTE: TRIGGERED BY FIRST USER ACCESS)
224
USER ACCESSES TUTORMAKER VIA NETWORK ADDRESS
226
BROWSER EXTENSION DOWNLOADED BY SERVER TO USER'S CLIENT COMPUTER
228
USER QUERIES TUTORMAKER
EXIT QUERY ?
232
YES
DONE
NO
PEDAGOGY EXISTS FOR QUERY?
234
YES
238
NO
236
TUTORMAKER GENERATES PEDAGOGY USING PEDAGOGY GENERATOR
TUTORMAKER READS PEDAGOGY
242
TUTORMAKER GENERATES HTML FOR PEDAGOGY AND RETURNS HTML TO USER VIA NETWORK

FIG. 28

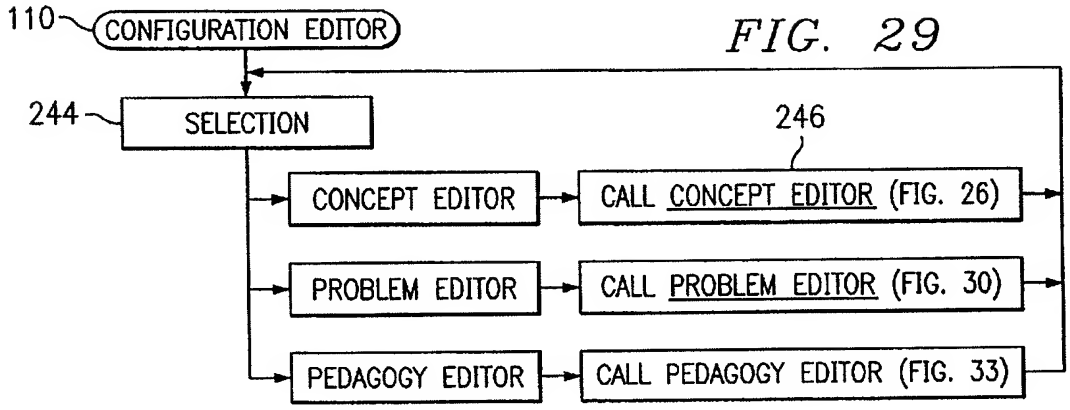

110
CONFIGURATION EDITOR
244
SELECTION
246
CONCEPT EDITOR
CALL CONCEPT EDITOR (FIG. 26)
PROBLEM EDITOR
CALL PROBLEM EDITOR (FIG. 30)
PEDAGOGY EDITOR
CALL PEDAGOGY EDITOR (FIG. 33)

FIG. 29

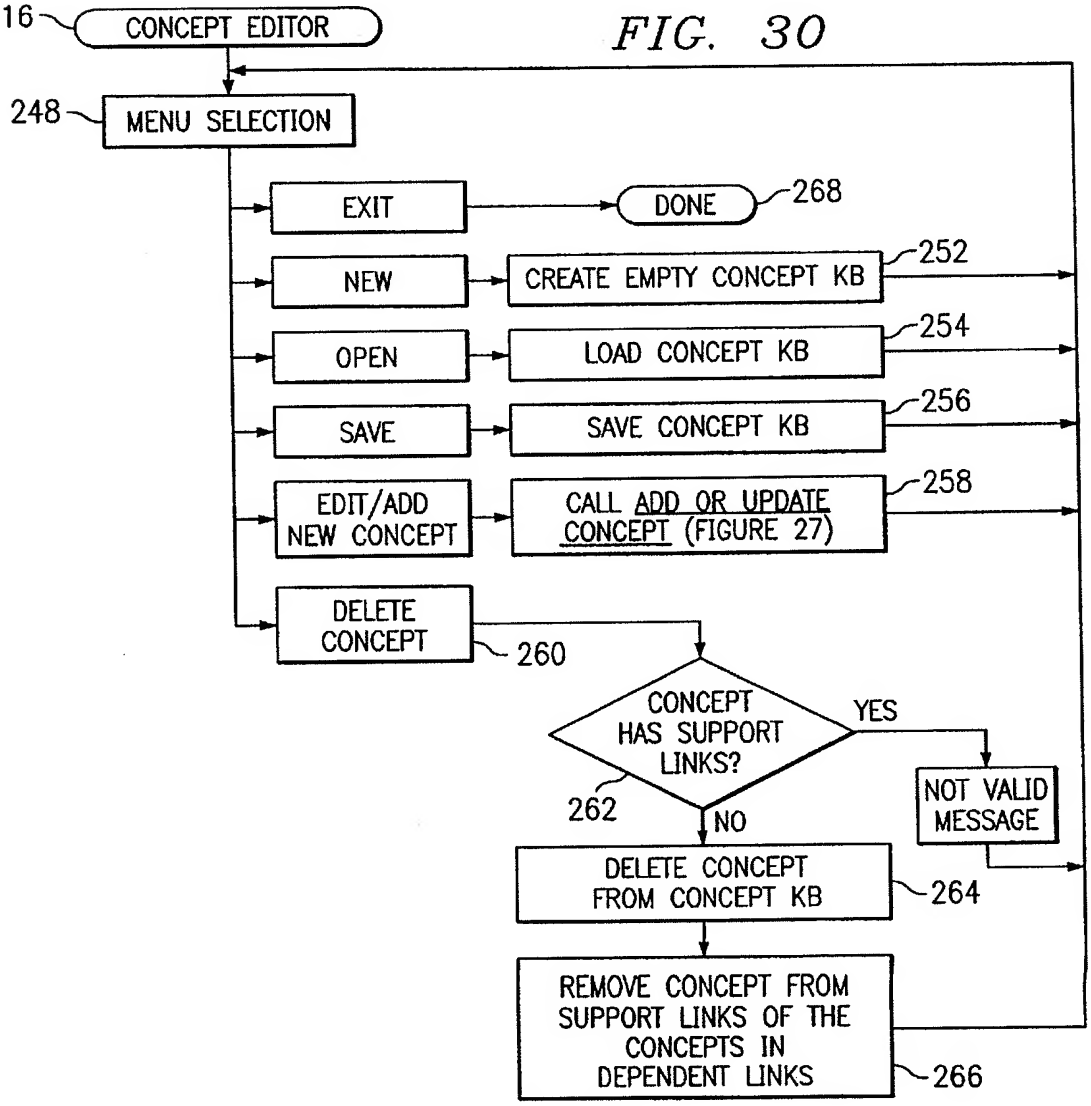

16
CONCEPT EDITOR
248
MENU SELECTION
EXIT
DONE
268
NEW
CREATE EMPTY CONCEPT KB
252
OPEN
LOAD CONCEPT KB
254
SAVE
SAVE CONCEPT KB
256
EDIT/ADD NEW CONCEPT
CALL ADD OR UPDATE CONCEPT (FIGURE 27)
258
DELETE CONCEPT
260
CONCEPT HAS SUPPORT LINKS?
YES
262
NO
NOT VALID MESSAGE
DELETE CONCEPT FROM CONCEPT KB
264
REMOVE CONCEPT FROM SUPPORT LINKS OF THE CONCEPTS IN DEPENDENT LINKS
266

FIG. 30

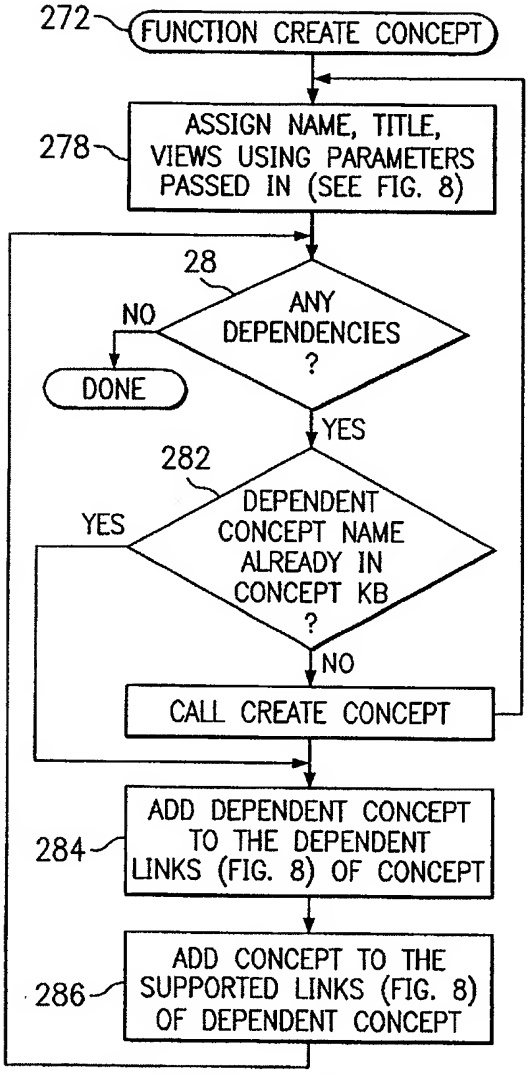

272
FUNCTION CREATE CONCEPT
278
ASSIGN NAME, TITLE, VIEWS USING PARAMETERS PASSED IN (SEE FIG. 8)
28
ANY DEPENDENCIES ?
NO
DONE
YES
282
DEPENDENT CONCEPT NAME ALREADY IN CONCEPT KB ?
YES
NO
CALL CREATE CONCEPT
284
ADD DEPENDENT CONCEPT TO THE DEPENDENT LINKS (FIG. 8) OF CONCEPT
286
ADD CONCEPT TO THE SUPPORTED LINKS (FIG. 8) OF DEPENDENT CONCEPT

FIG. 32

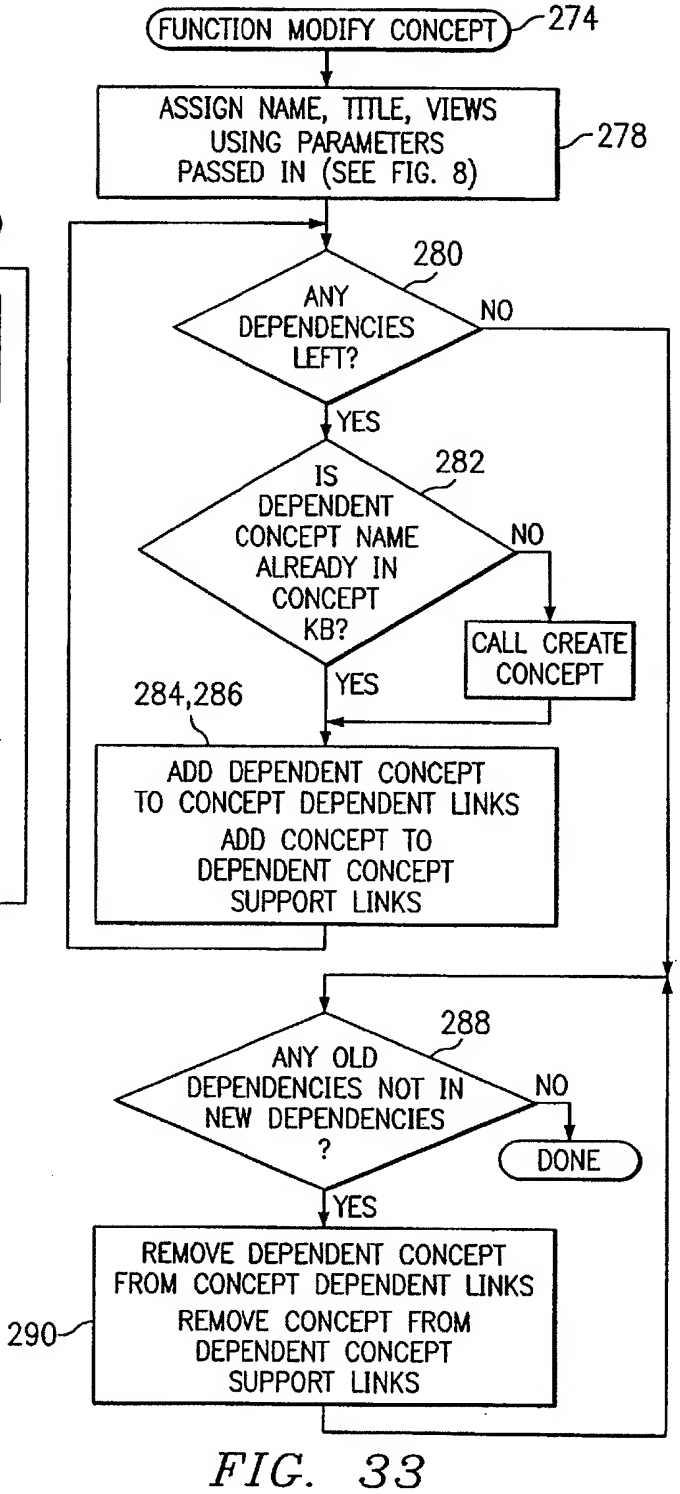

FUNCTION MODIFY CONCEPT
274
ASSIGN NAME, TITLE, VIEWS USING PARAMETERS PASSED IN (SEE FIG. 8)
278
280
ANY DEPENDENCIES LEFT?
NO
YES
282
IS DEPENDENT CONCEPT NAME ALREADY IN CONCEPT KB?
NO
CALL CREATE CONCEPT
YES
284,286
ADD DEPENDENT CONCEPT TO CONCEPT DEPENDENT LINKS
ADD CONCEPT TO DEPENDENT CONCEPT SUPPORT LINKS
288
ANY OLD DEPENDENCIES NOT IN NEW DEPENDENCIES ?
NO
DONE
YES
290
REMOVE DEPENDENT CONCEPT FROM CONCEPT DEPENDENT LINKS
REMOVE CONCEPT FROM DEPENDENT CONCEPT SUPPORT LINKS

FIG. 33

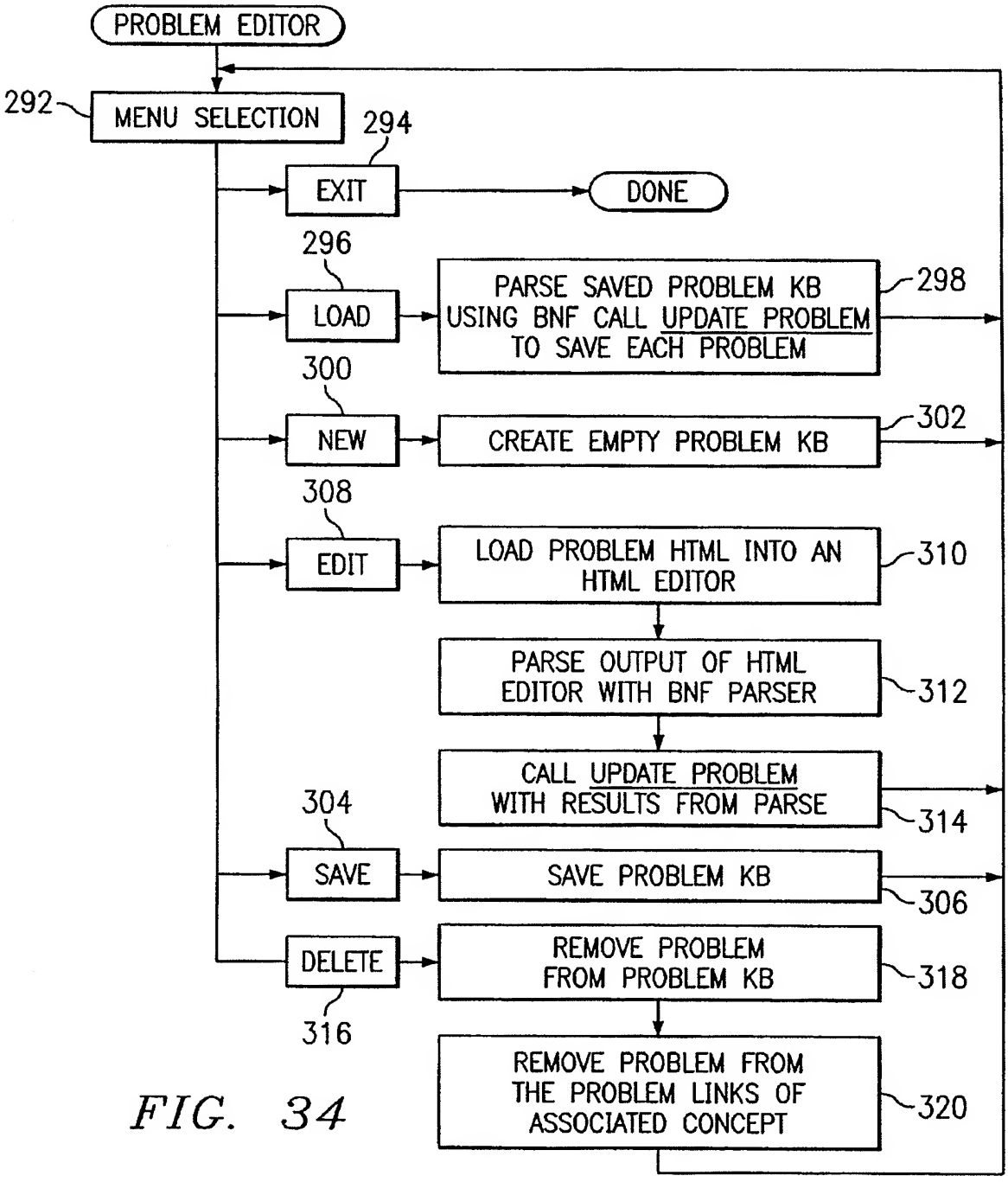

PROBLEM EDITOR
292
MENU SELECTION
294
EXIT
DONE
296
LOAD
PARSE SAVED PROBLEM KB USING BNF CALL UPDATE PROBLEM TO SAVE EACH PROBLEM
298
300
NEW
CREATE EMPTY PROBLEM KB
302
308
EDIT
LOAD PROBLEM HTML INTO AN HTML EDITOR
310
PARSE OUTPUT OF HTML EDITOR WITH BNF PARSER
312
CALL UPDATE PROBLEM WITH RESULTS FROM PARSE
314
304
SAVE
SAVE PROBLEM KB
306
DELETE
REMOVE PROBLEM FROM PROBLEM KB
318
316
REMOVE PROBLEM FROM THE PROBLEM LINKS OF ASSOCIATED CONCEPT
320

FIG. 34

FIG. 35

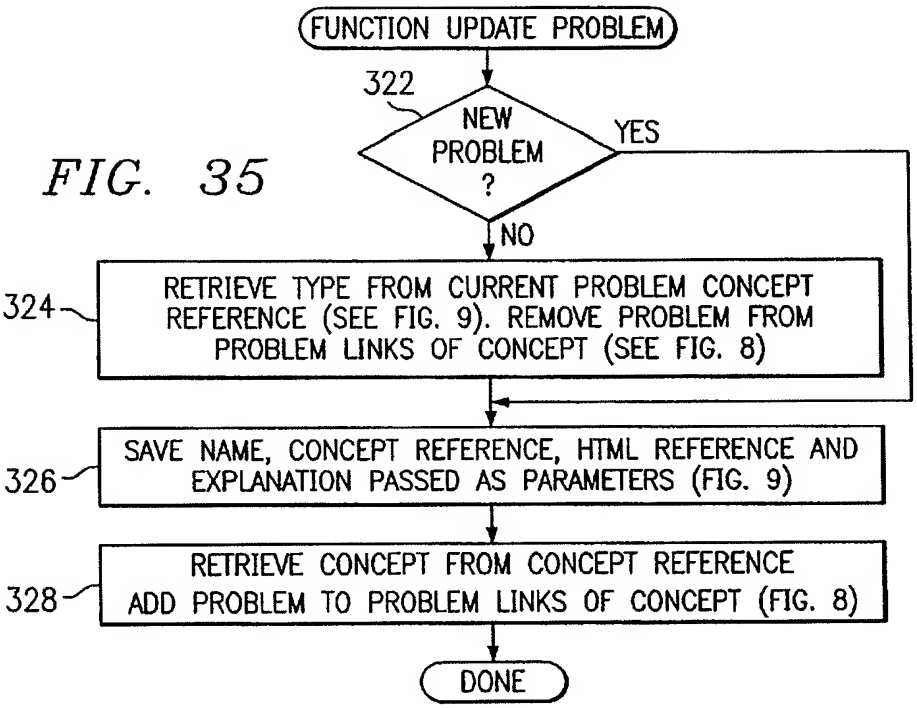
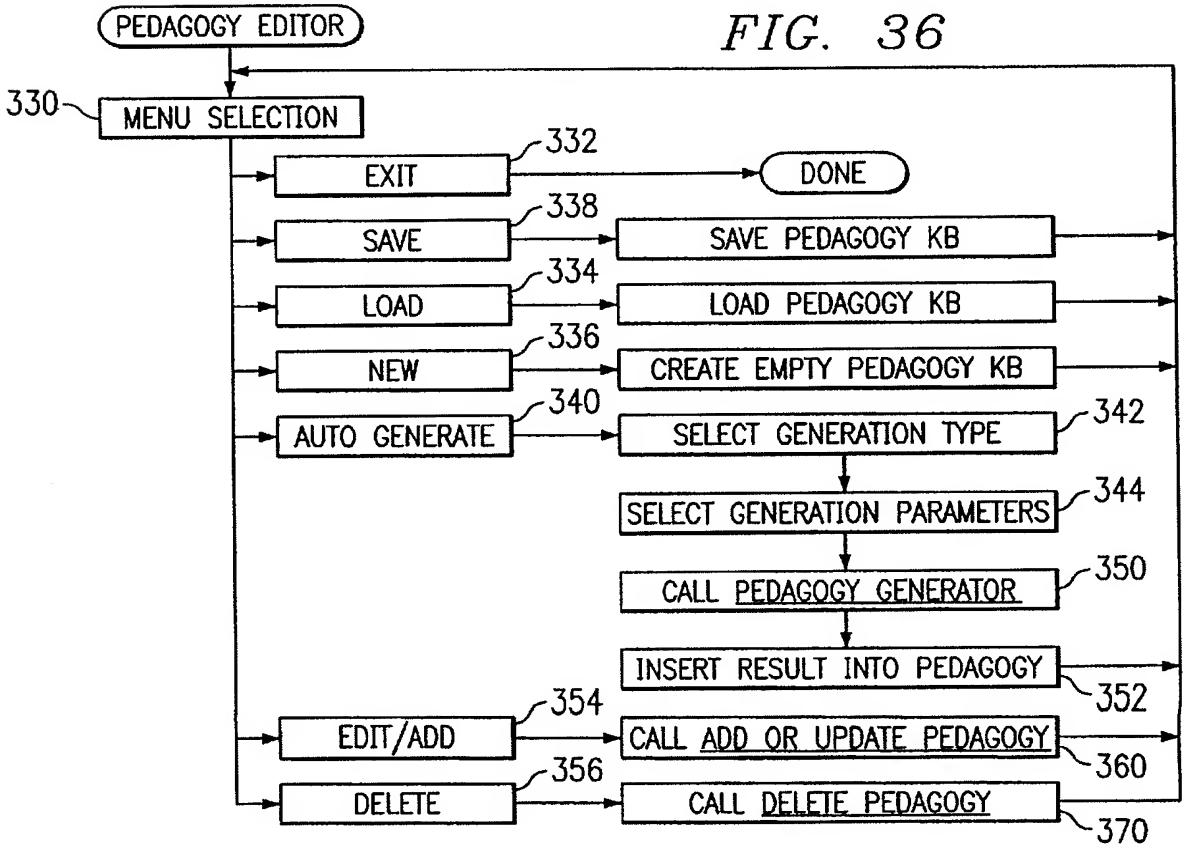

FUNCTION UPDATE PROBLEM
322
NEW PROBLEM ?
YES
NO
324
RETRIEVE TYPE FROM CURRENT PROBLEM CONCEPT REFERENCE (SEE FIG. 9). REMOVE PROBLEM FROM PROBLEM LINKS OF CONCEPT (SEE FIG. 8)
326
SAVE NAME, CONCEPT REFERENCE, HTML REFERENCE AND EXPLANATION PASSED AS PARAMETERS (FIG. 9)
328
RETRIEVE CONCEPT FROM CONCEPT REFERENCE ADD PROBLEM TO PROBLEM LINKS OF CONCEPT (FIG. 8)
DONE

FIG. 36


PEDAGOGY EDITOR
330
MENU SELECTION
EXIT
332
DONE
SAVE
338
SAVE PEDAGOGY KB
LOAD
334
LOAD PEDAGOGY KB
NEW
336
CREATE EMPTY PEDAGOGY KB
AUTO GENERATE
340
SELECT GENERATION TYPE
342
SELECT GENERATION PARAMETERS
344
CALL PEDAGOGY GENERATOR
350
INSERT RESULT INTO PEDAGOGY
352
EDIT/ADD
354
CALL ADD OR UPDATE PEDAGOGY
360
DELETE
356
CALL DELETE PEDAGOGY
370

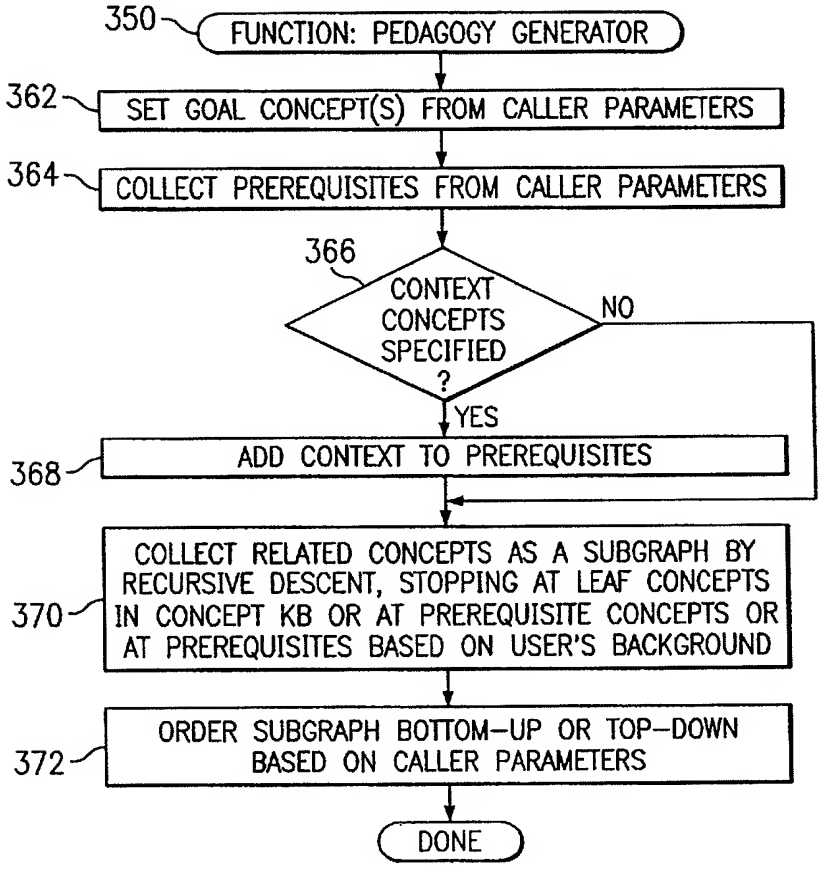


FIG. 37A

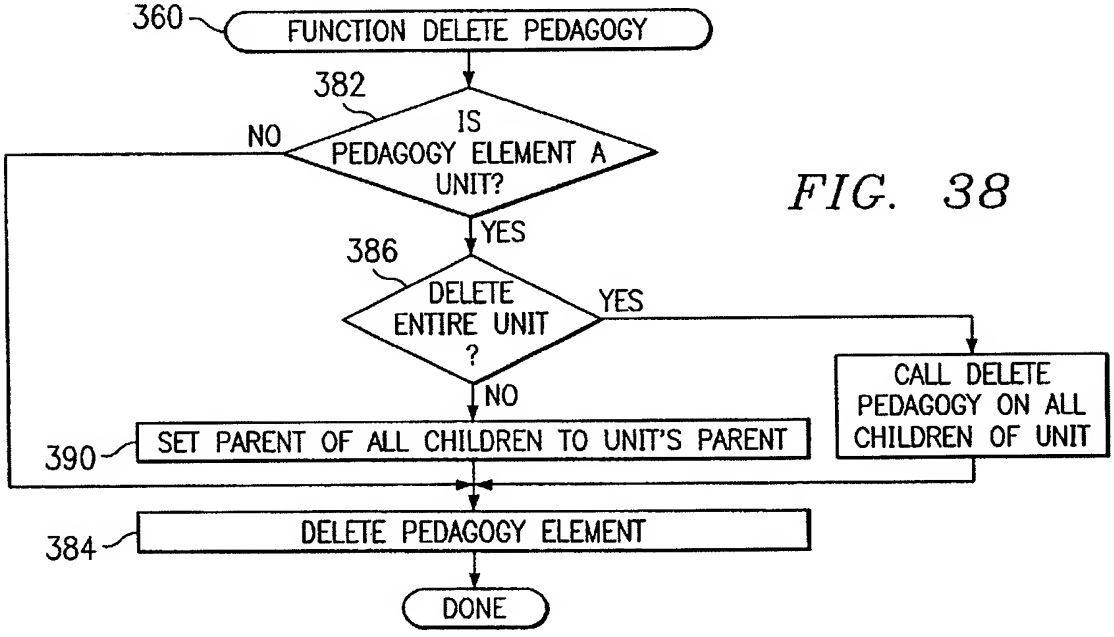


FIG. 38

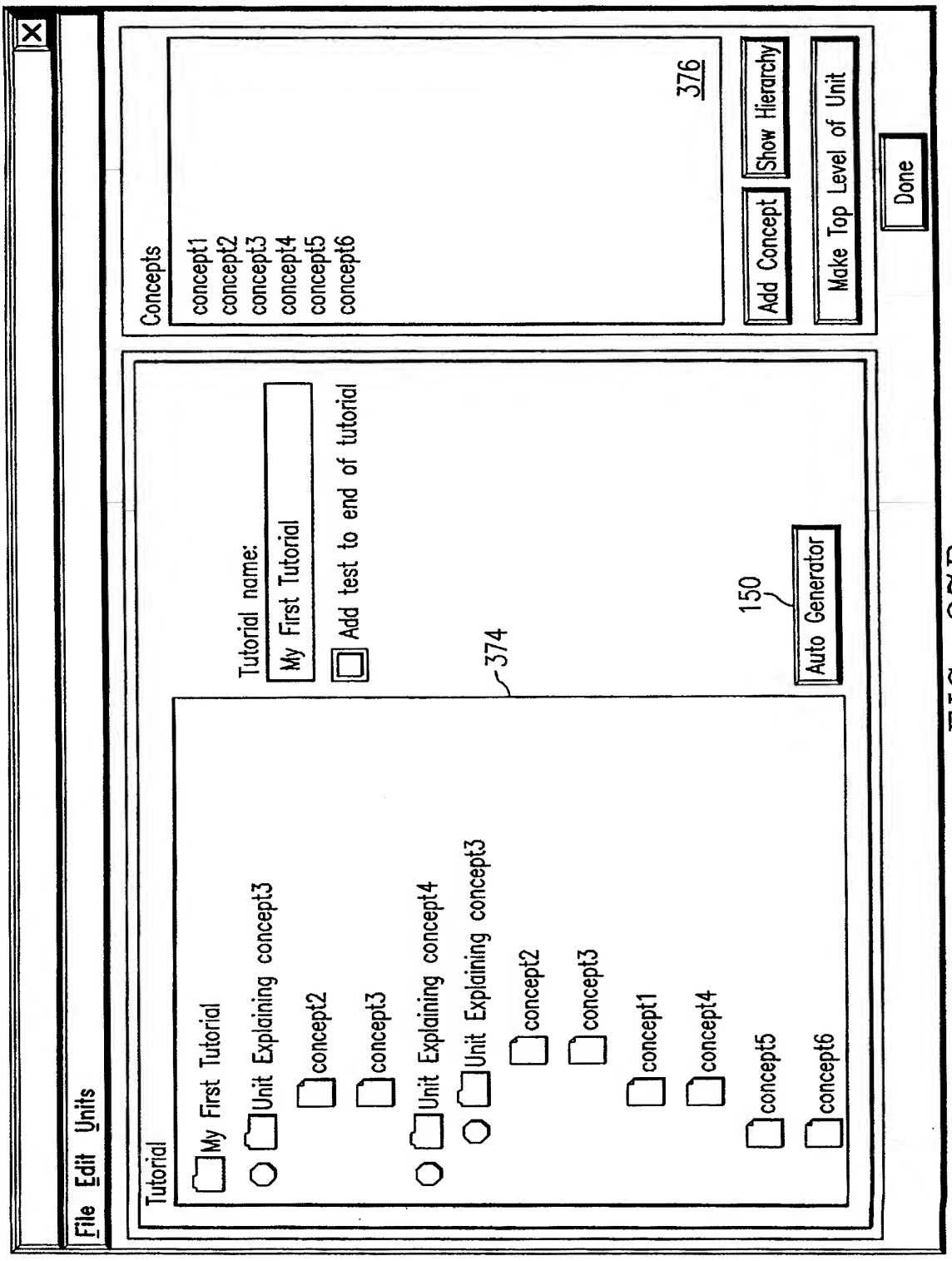
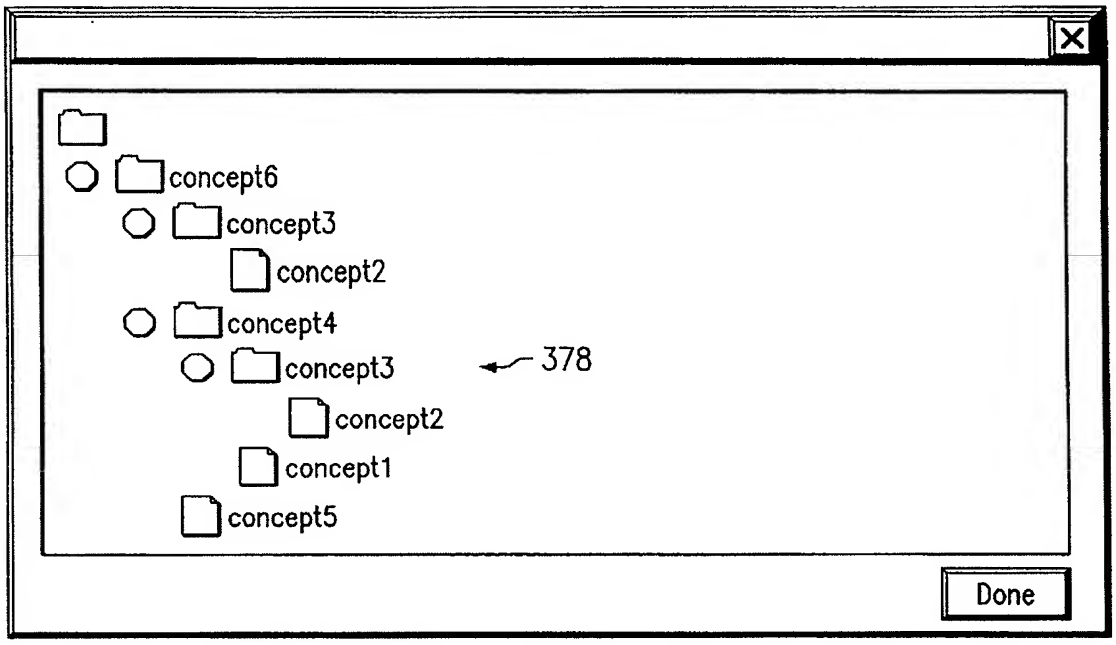

File Edit Units
Tutorial
My First Tutorial
Unit Explaining concept3
concept2
concept3
Unit Explaining concept4
Unit Explaining concept3
concept2
concept3
concept1
concept4
concept5
concept6
374
Tutorial name:
My First Tutorial
Add test to end of tutorial
150
Auto Generator
Concepts
concept1
concept2
concept3
concept4
concept5
concept6
376
Add Concept
Show Hierarchy
Make Top Level of Unit
Done

FIG. 37B

FIG. 37C



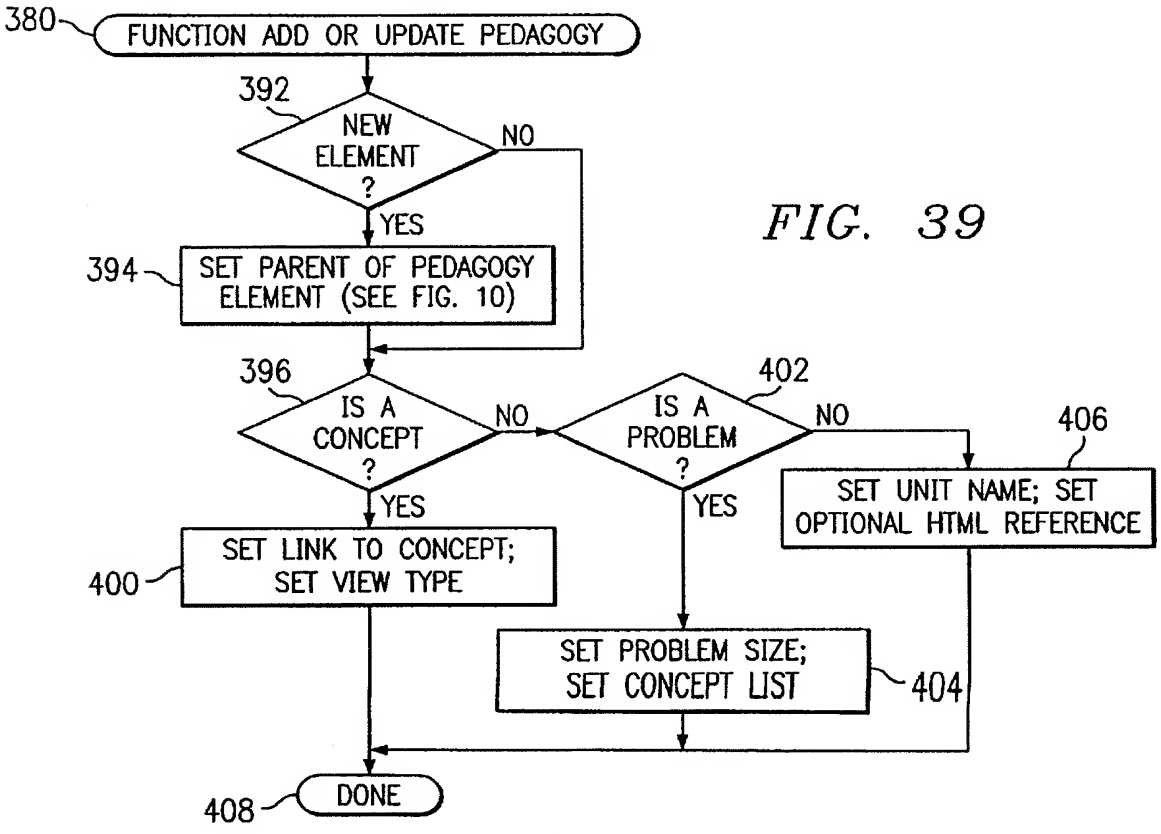


FIG. 39

FIG. 40

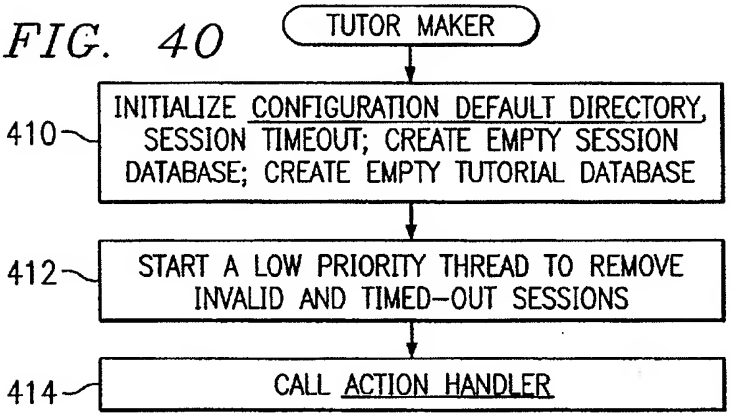

TUTOR MAKER
410
INITIALIZE CONFIGURATION DEFAULT DIRECTORY, SESSION TIMEOUT; CREATE EMPTY SESSION DATABASE; CREATE EMPTY TUTORIAL DATABASE
412
START A LOW PRIORITY THREAD TO REMOVE INVALID AND TIMED-OUT SESSIONS
414
CALL ACTION HANDLER

FIG. 42

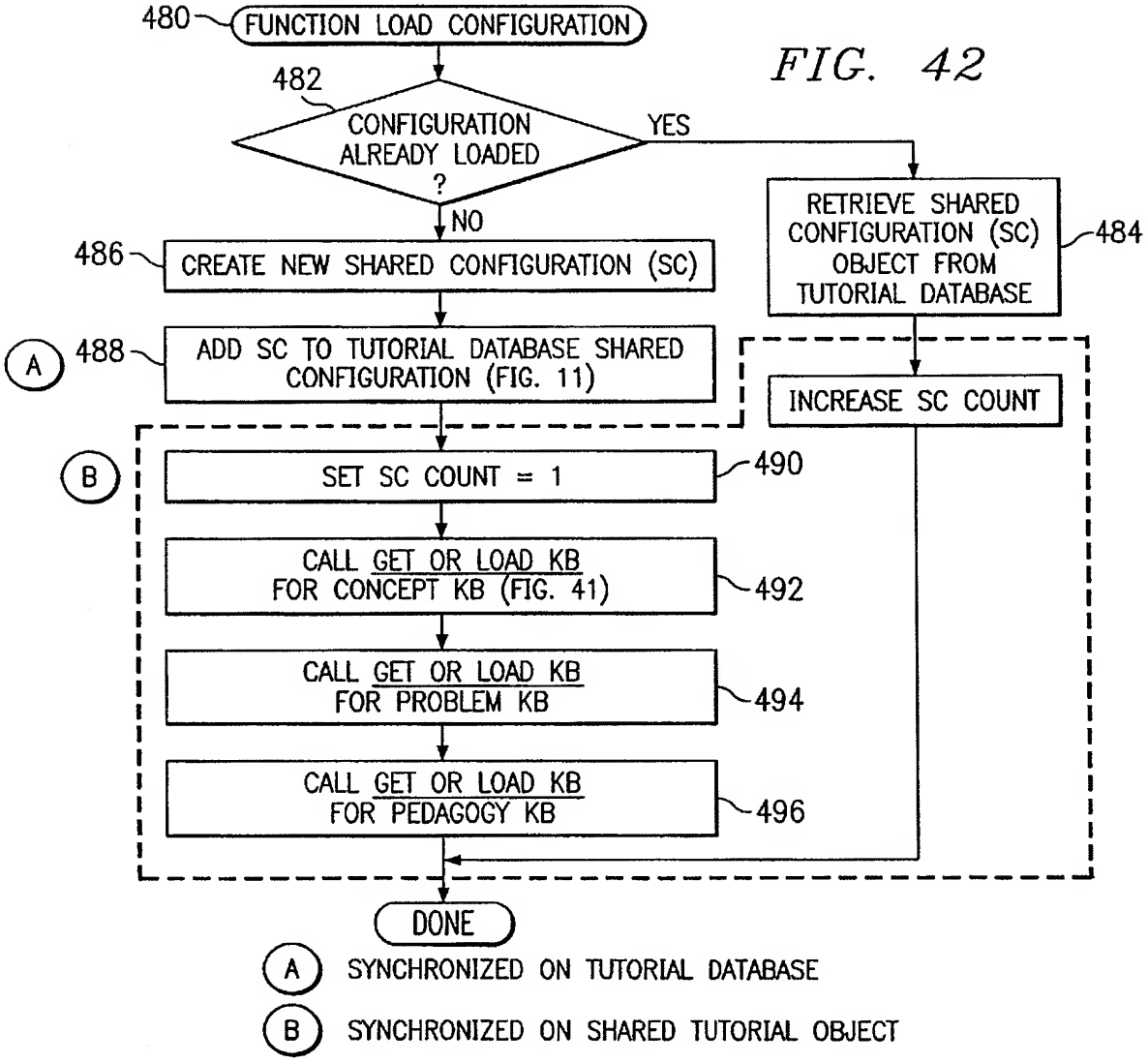
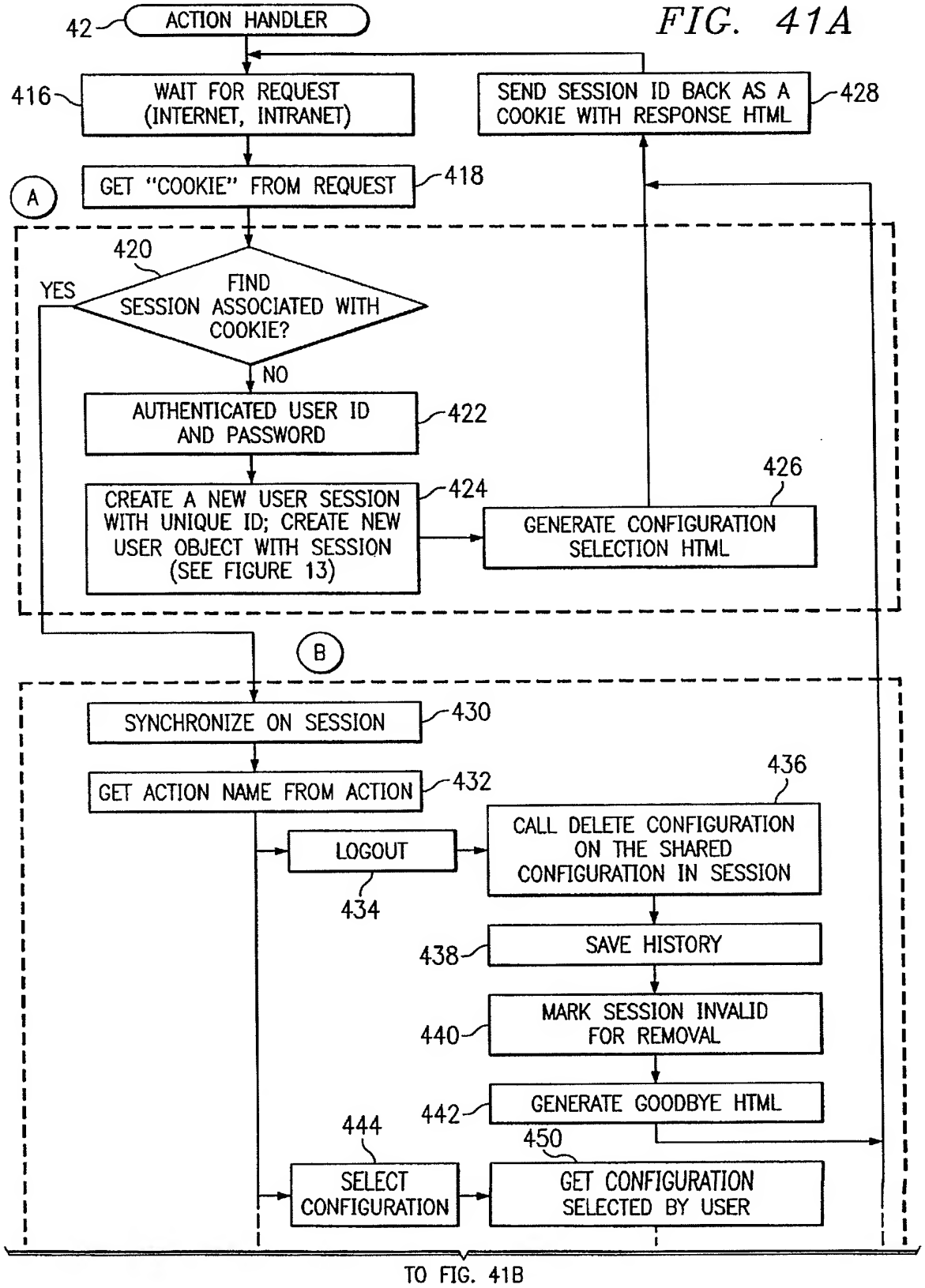

480
FUNCTION LOAD CONFIGURATION
482
CONFIGURATION ALREADY LOADED ?
YES
NO
RETRIEVE SHARED CONFIGURATION (SC) OBJECT FROM TUTORIAL DATABASE
484
INCREASE SC COUNT
486
CREATE NEW SHARED CONFIGURATION (SC)
A
488
ADD SC TO TUTORIAL DATABASE SHARED CONFIGURATION (FIG. 11)
B
SET SC COUNT = 1
490
CALL GET OR LOAD KB FOR CONCEPT KB (FIG. 41)
492
CALL GET OR LOAD KB FOR PROBLEM KB
494
CALL GET OR LOAD KB FOR PEDAGOGY KB
496
DONE
A SYNCHRONIZED ON TUTORIAL DATABASE
B SYNCHRONIZED ON SHARED TUTORIAL OBJECT

FIG. 41A



TO FIG. 41B

FIG. 41B

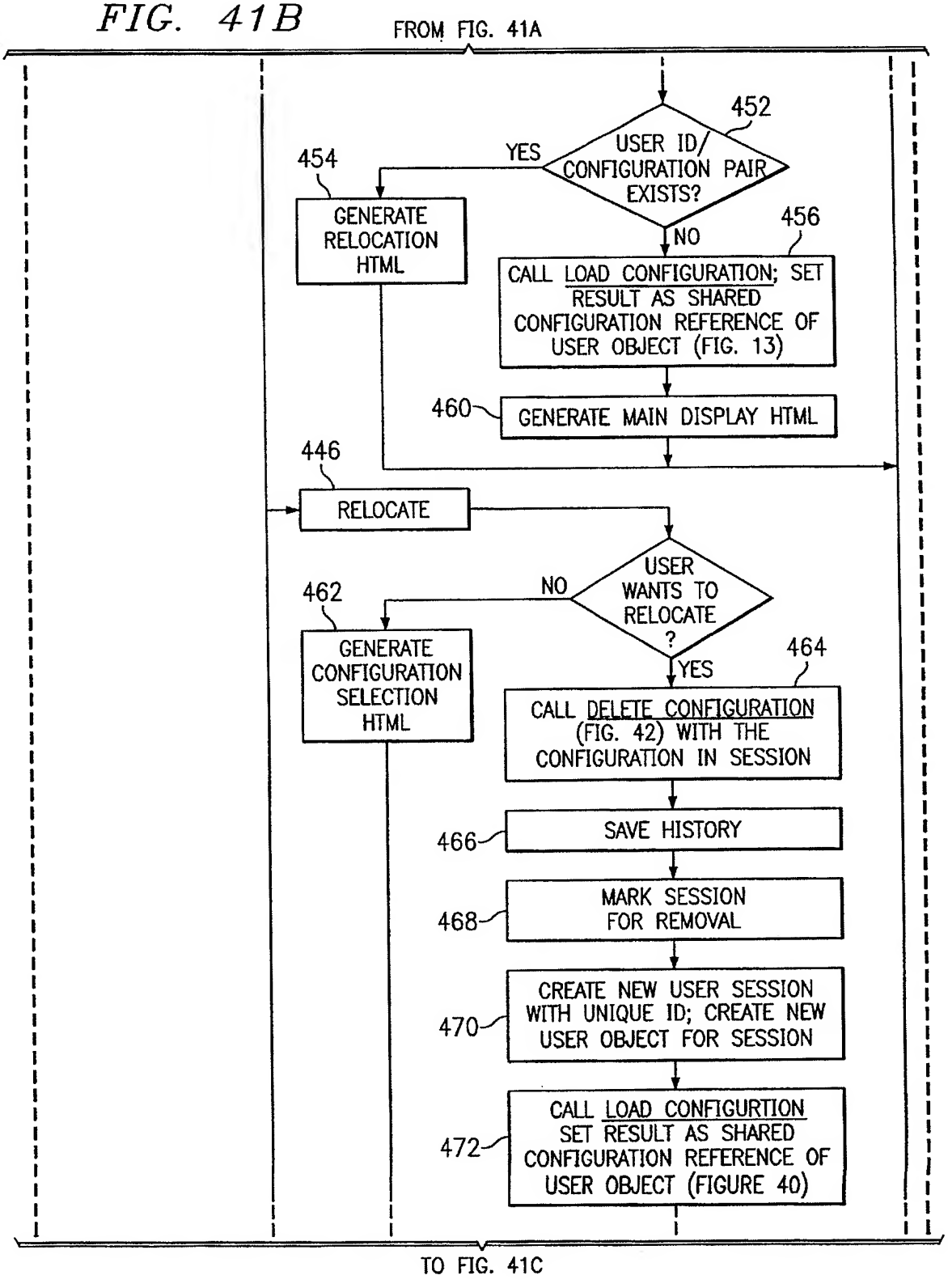

FROM FIG. 41A
452
USER ID/ CONFIGURATION PAIR EXISTS?
YES
454
GENERATE RELOCATION HTML
NO
456
CALL LOAD CONFIGURATION; SET RESULT AS SHARED CONFIGURATION REFERENCE OF USER OBJECT (FIG. 13)
460
GENERATE MAIN DISPLAY HTML
446
RELOCATE
USER WANTS TO RELOCATE ?
NO
462
GENERATE CONFIGURATION SELECTION HTML
YES
464
CALL DELETE CONFIGURATION (FIG. 42) WITH THE CONFIGURATION IN SESSION
466
SAVE HISTORY
468
MARK SESSION FOR REMOVAL
470
CREATE NEW USER SESSION WITH UNIQUE ID; CREATE NEW USER OBJECT FOR SESSION
472
CALL LOAD CONFIGURTION SET RESULT AS SHARED CONFIGURATION REFERENCE OF USER OBJECT (FIGURE 40)
TO FIG. 41C

FIG. 41C

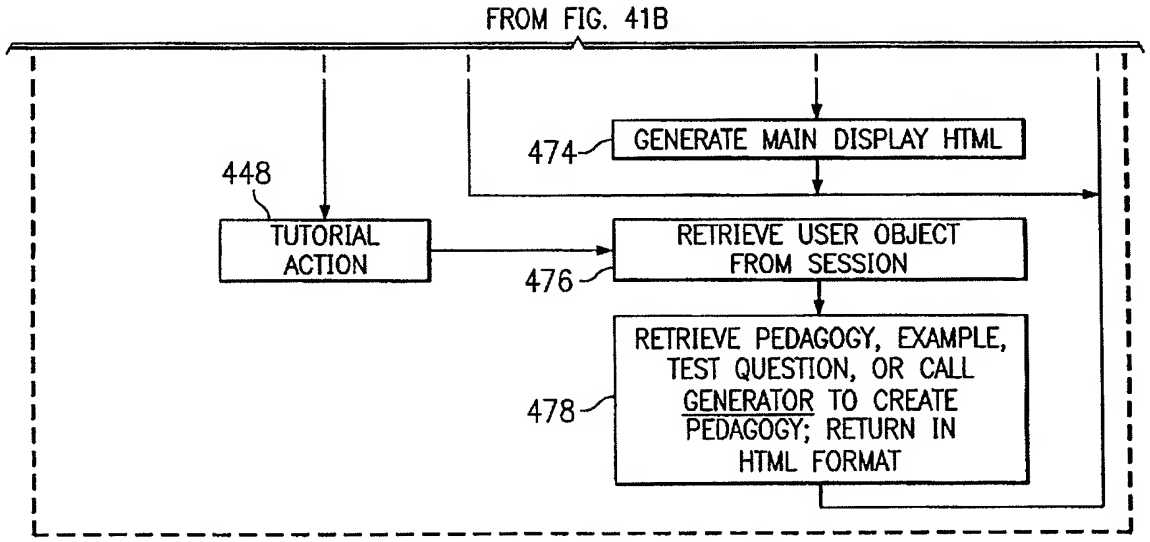


FIG. 44

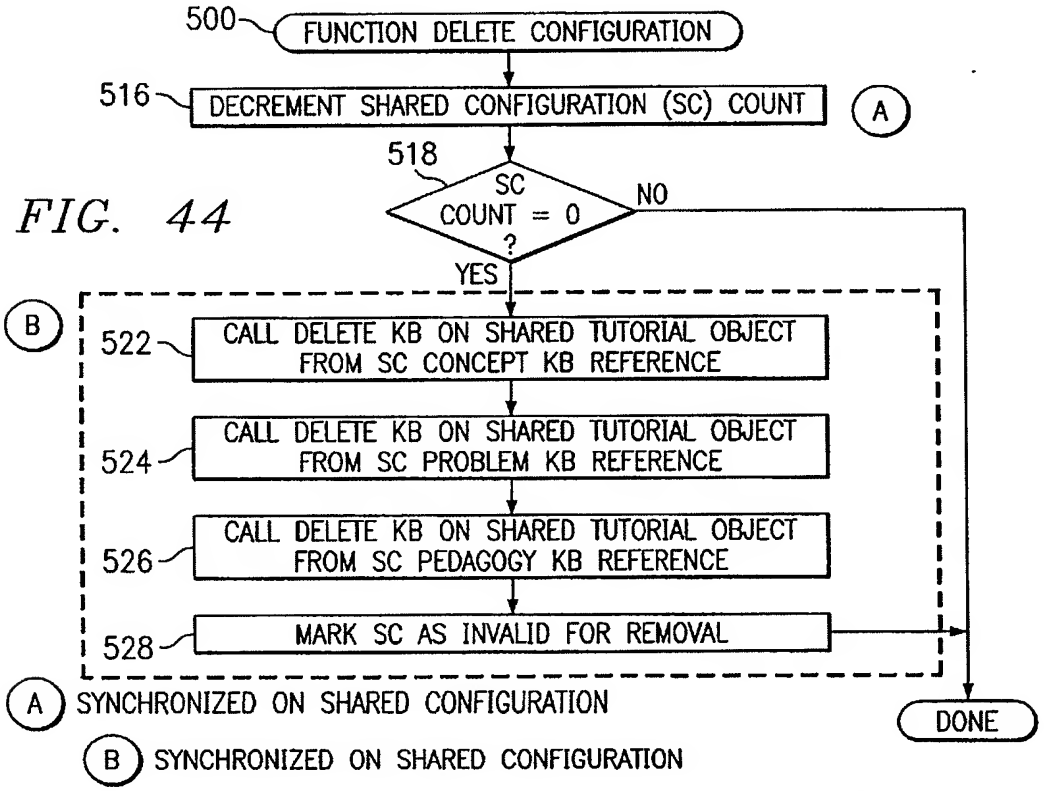


FIG. 43

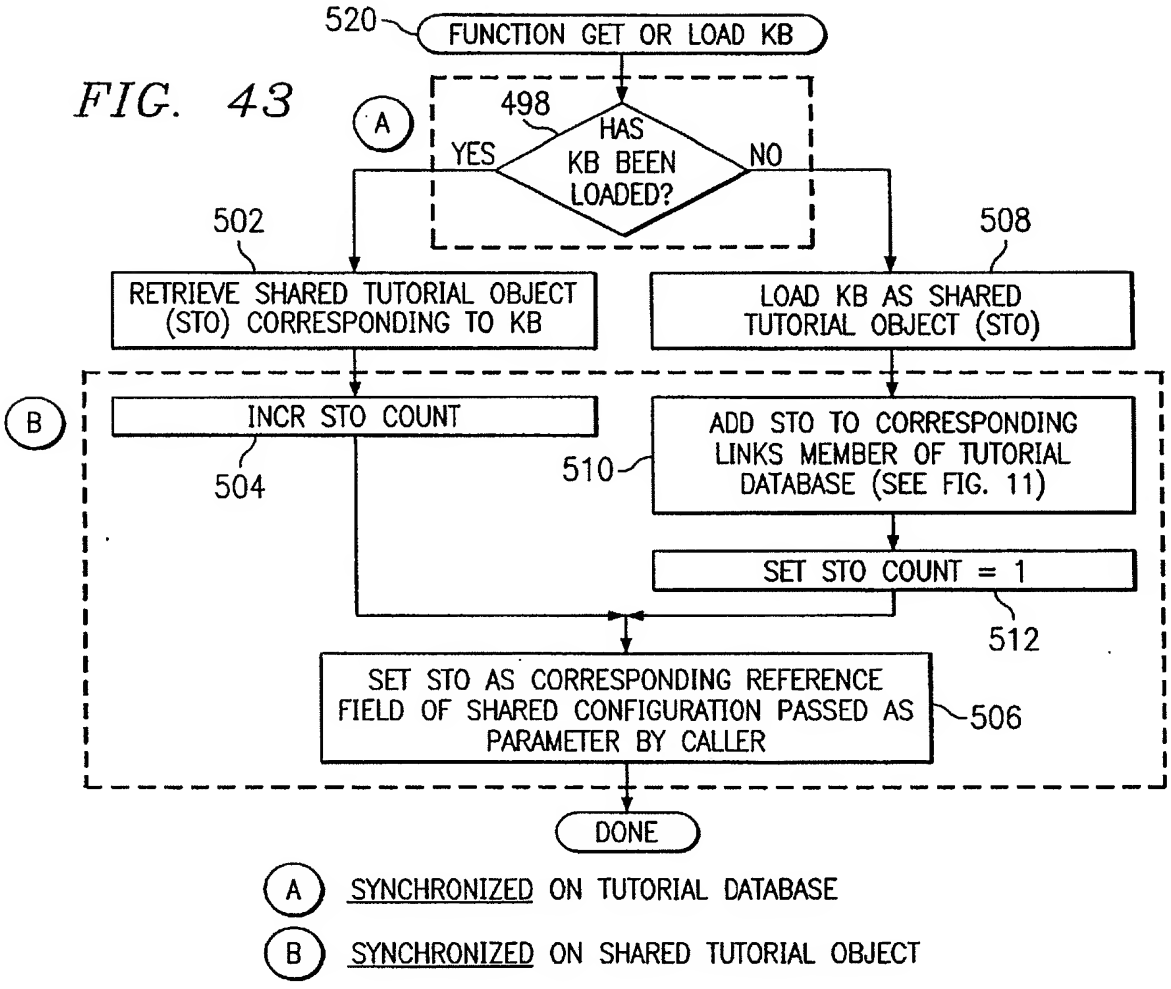
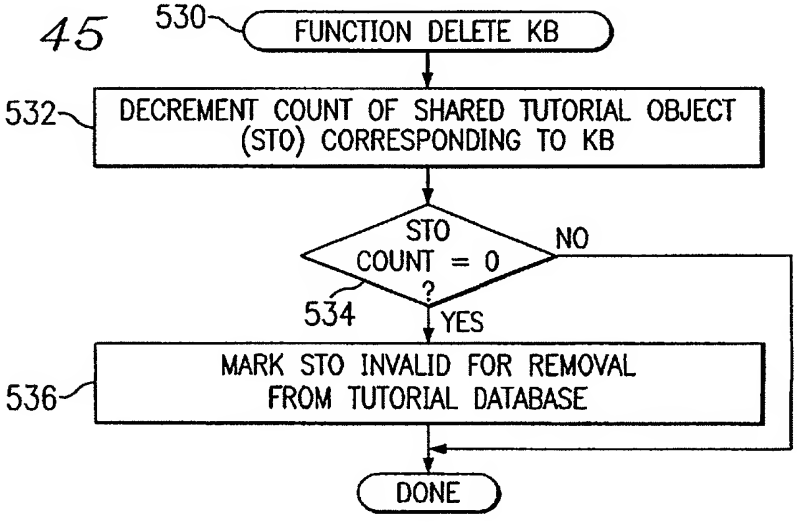

520
FUNCTION GET OR LOAD KB
A
498
HAS KB BEEN LOADED?
YES
NO
502
RETRIEVE SHARED TUTORIAL OBJECT (STO) CORRESPONDING TO KB
508
LOAD KB AS SHARED TUTORIAL OBJECT (STO)
B
INCR STO COUNT
504
510
ADD STO TO CORRESPONDING LINKS MEMBER OF TUTORIAL DATABASE (SEE FIG. 11)
SET STO COUNT = 1
512
SET STO AS CORRESPONDING REFERENCE FIELD OF SHARED CONFIGURATION PASSED AS PARAMETER BY CALLER
506
DONE
A SYNCHRONIZED ON TUTORIAL DATABASE
B SYNCHRONIZED ON SHARED TUTORIAL OBJECT

FIG. 45


530
FUNCTION DELETE KB
532
DECREMENT COUNT OF SHARED TUTORIAL OBJECT (STO) CORRESPONDING TO KB
STO COUNT = 0 ?
NO
534
YES
536
MARK STO INVALID FOR REMOVAL FROM TUTORIAL DATABASE
DONE

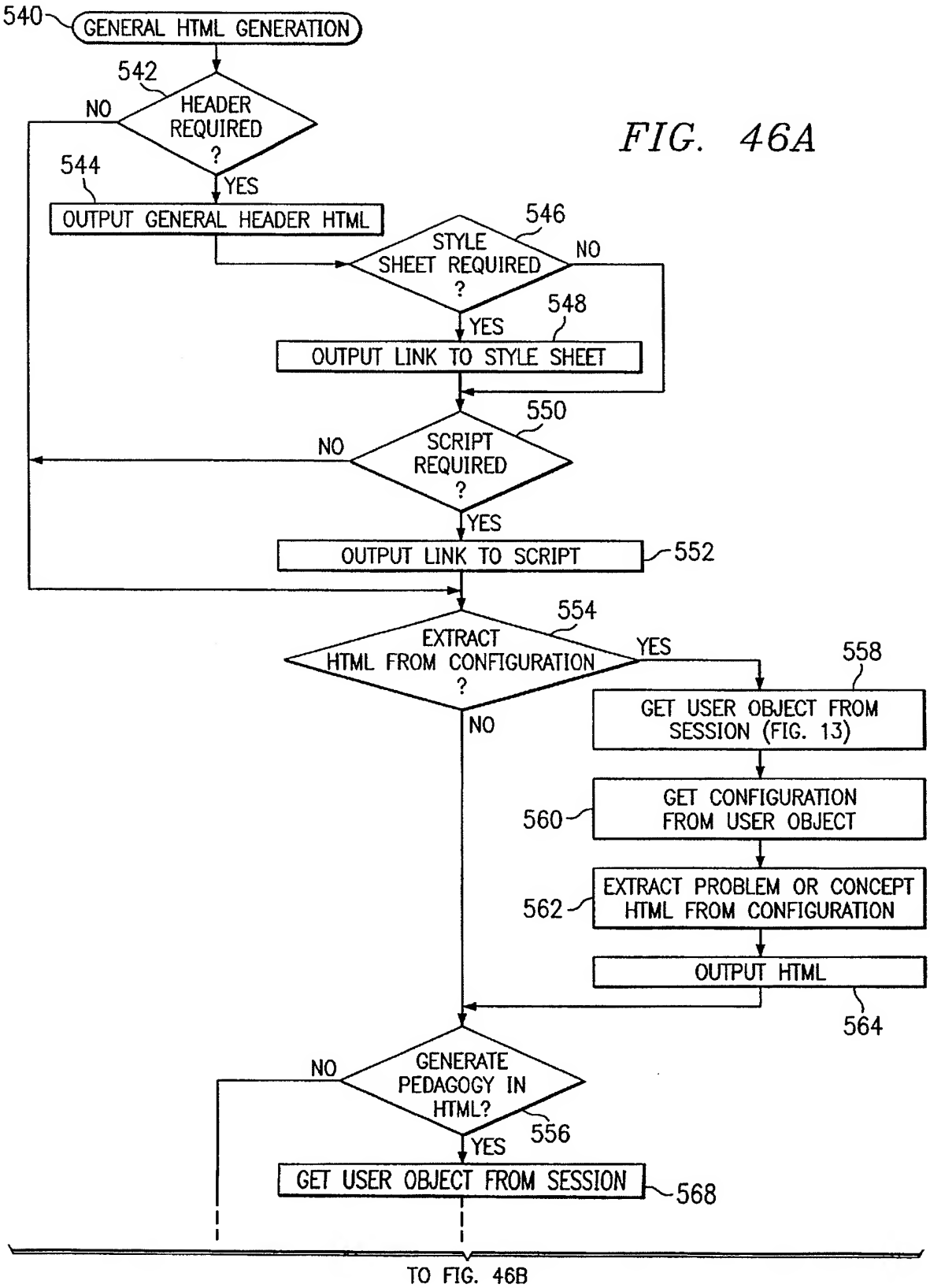

540
GENERAL HTML GENERATION
542
HEADER REQUIRED ?
NO
YES
544
OUTPUT GENERAL HEADER HTML
546
STYLE SHEET REQUIRED ?
NO
YES
548
OUTPUT LINK TO STYLE SHEET
550
SCRIPT REQUIRED ?
NO
YES
OUTPUT LINK TO SCRIPT
552
554
EXTRACT HTML FROM CONFIGURATION ?
YES
NO
558
GET USER OBJECT FROM SESSION (FIG. 13)
560
GET CONFIGURATION FROM USER OBJECT
562
EXTRACT PROBLEM OR CONCEPT HTML FROM CONFIGURATION
OUTPUT HTML
564
NO
GENERATE PEDAGOGY IN HTML?
556
YES
GET USER OBJECT FROM SESSION
568
TO FIG. 46B

FIG. 46A

FIG. 46B

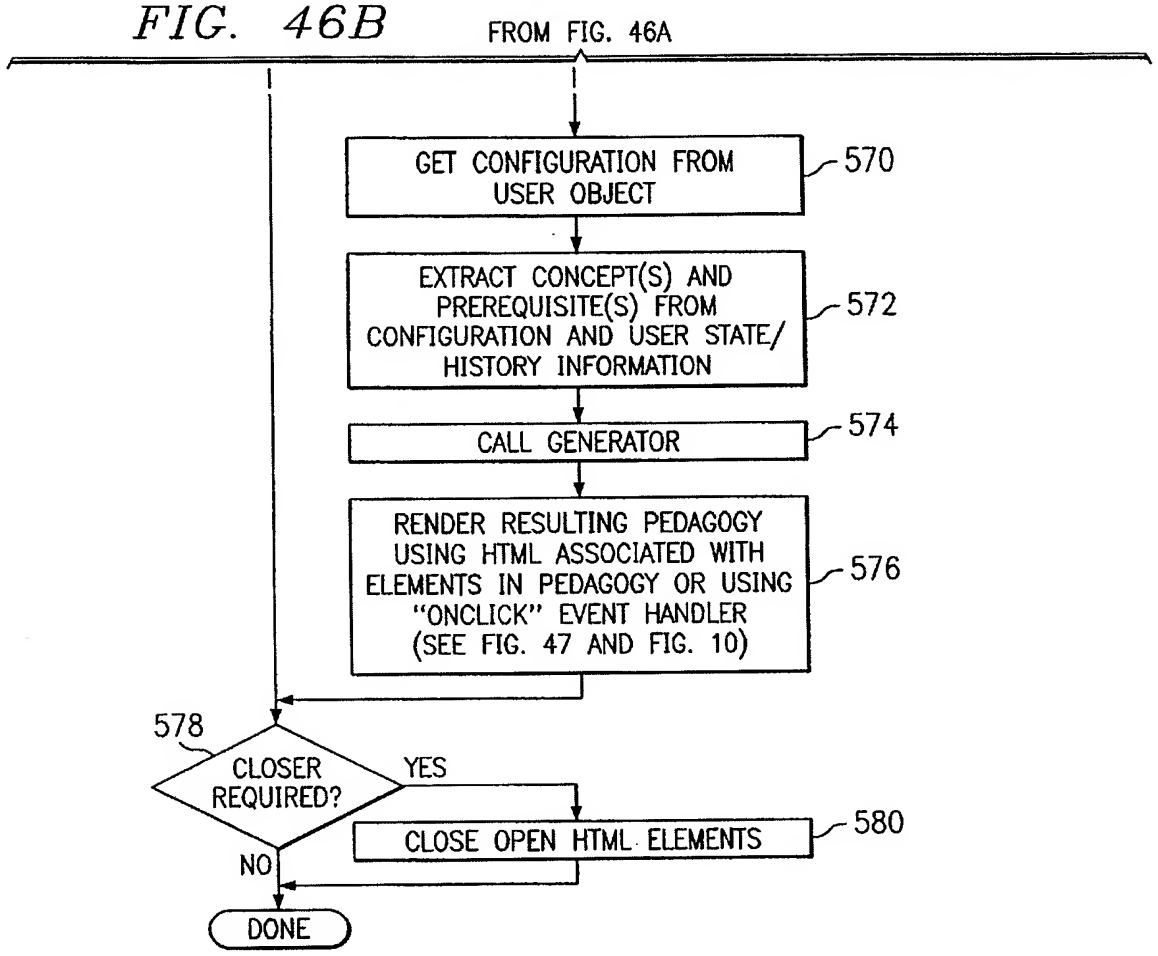


FIG. 47

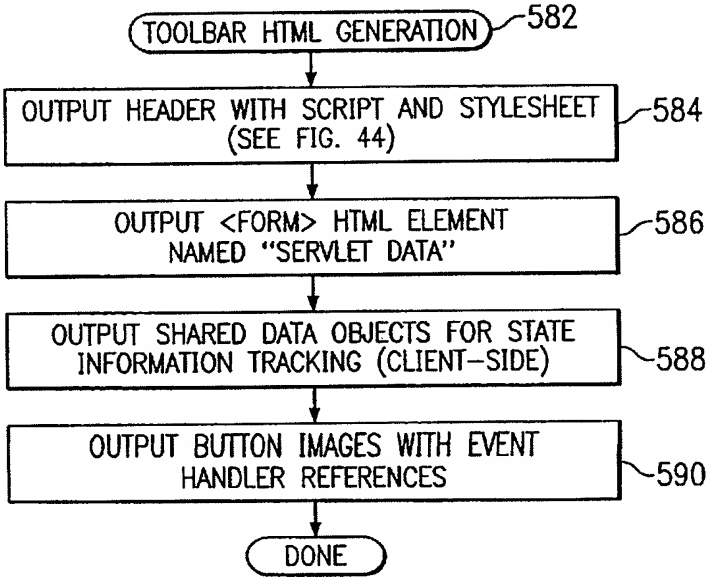
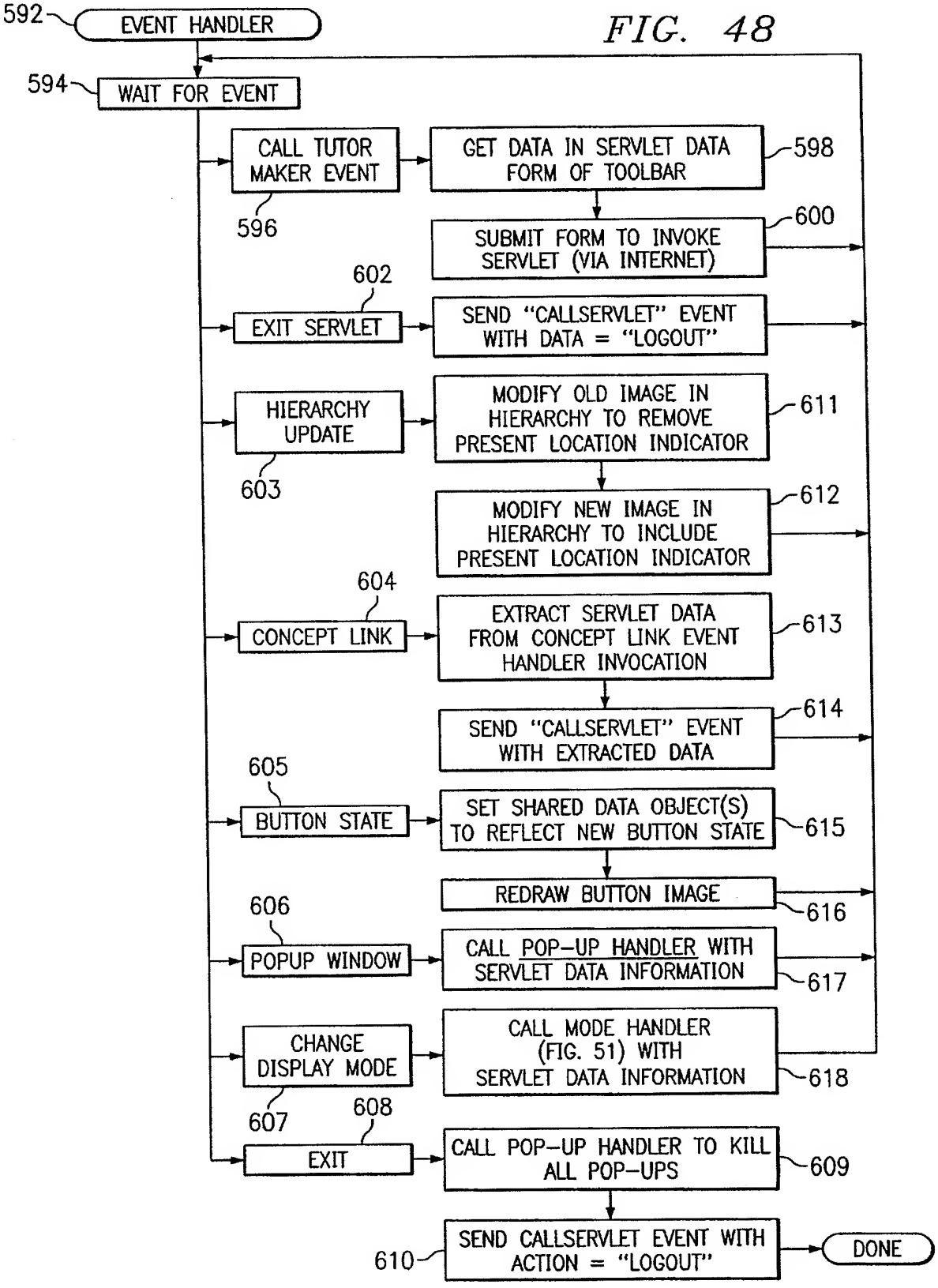


FIG. 48


592
EVENT HANDLER
594
WAIT FOR EVENT
CALL TUTOR MAKER EVENT
596
GET DATA IN SERVLET DATA FORM OF TOOLBAR
598
SUBMIT FORM TO INVOKE SERVLET (VIA INTERNET)
600
602
EXIT SERVLET
SEND "CALLSERVLET" EVENT WITH DATA = "LOGOUT"
HIERARCHY UPDATE
603
MODIFY OLD IMAGE IN HIERARCHY TO REMOVE PRESENT LOCATION INDICATOR
611
MODIFY NEW IMAGE IN HIERARCHY TO INCLUDE PRESENT LOCATION INDICATOR
612
604
CONCEPT LINK
EXTRACT SERVLET DATA FROM CONCEPT LINK EVENT HANDLER INVOCATION
613
SEND "CALLSERVLET" EVENT WITH EXTRACTED DATA
614
605
BUTTON STATE
SET SHARED DATA OBJECT(S) TO REFLECT NEW BUTTON STATE
615
REDRAW BUTTON IMAGE
616
606
POPUP WINDOW
CALL POP-UP HANDLER WITH SERVLET DATA INFORMATION
617
CHANGE DISPLAY MODE
CALL MODE HANDLER (FIG. 51) WITH SERVLET DATA INFORMATION
618
607
608
EXIT
CALL POP-UP HANDLER TO KILL ALL POP-UPS
609
610
SEND CALLSERVLET EVENT WITH ACTION = "LOGOUT"
DONE

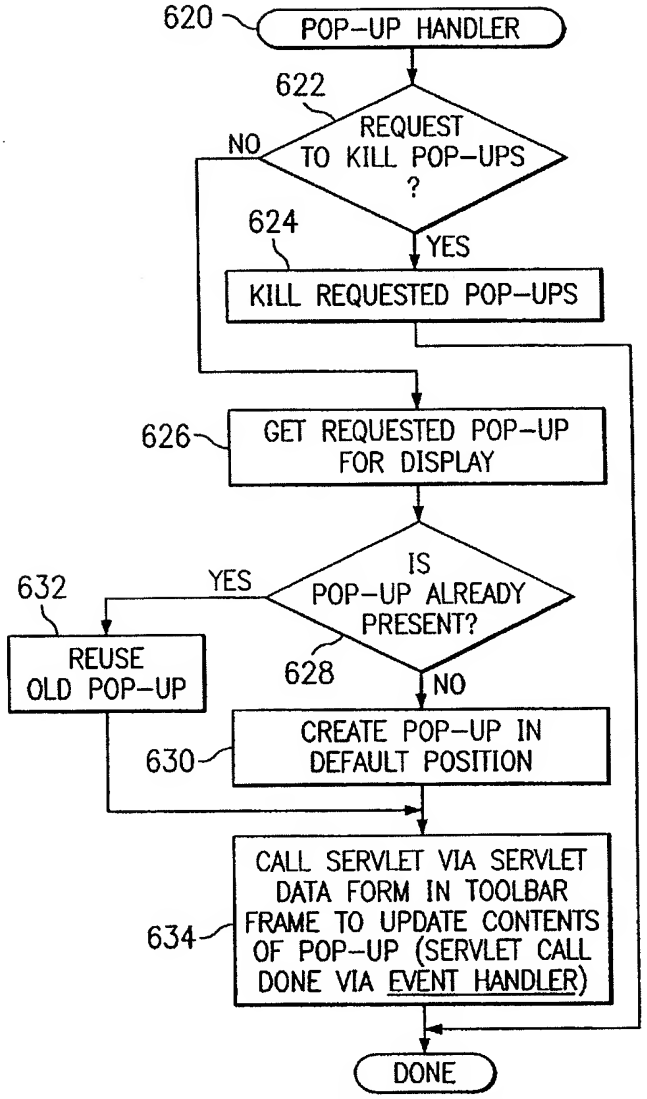

620
POP-UP HANDLER
622
REQUEST TO KILL POP-UPS ?
NO
YES
624
KILL REQUESTED POP-UPS
626
GET REQUESTED POP-UP FOR DISPLAY
IS POP-UP ALREADY PRESENT?
YES
632
REUSE OLD POP-UP
628
NO
630
CREATE POP-UP IN DEFAULT POSITION
634
CALL SERVLET VIA SERVLET DATA FORM IN TOOLBAR FRAME TO UPDATE CONTENTS OF POP-UP (SERVLET CALL DONE VIA EVENT HANDLER)
DONE

FIG. 49

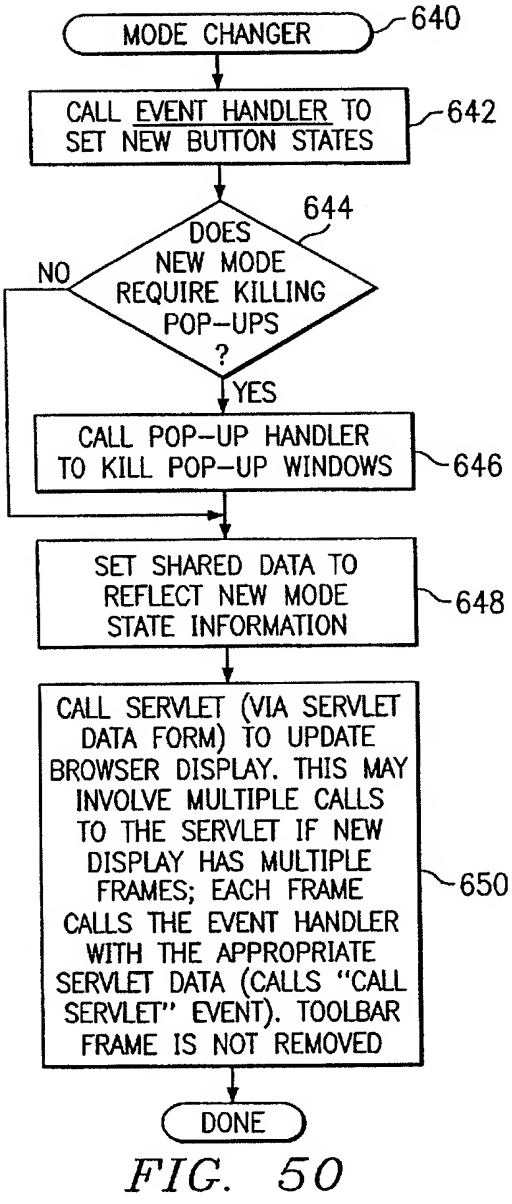

MODE CHANGER
640
CALL EVENT HANDLER TO SET NEW BUTTON STATES
642
644
DOES NEW MODE REQUIRE KILLING POP-UPS ?
NO
YES
CALL POP-UP HANDLER TO KILL POP-UP WINDOWS
646
SET SHARED DATA TO REFLECT NEW MODE STATE INFORMATION
648
CALL SERVLET (VIA SERVLET DATA FORM) TO UPDATE BROWSER DISPLAY. THIS MAY INVOLVE MULTIPLE CALLS TO THE SERVLET IF NEW DISPLAY HAS MULTIPLE FRAMES; EACH FRAME CALLS THE EVENT HANDLER WITH THE APPROPRIATE SERVLET DATA (CALLS "CALL SERVLET" EVENT). TOOLBAR FRAME IS NOT REMOVED
650
DONE

FIG. 50

SYSTEM AND METHOD FOR DYNAMIC KNOWLEDGE GENERATION AND DISTRIBUTION

GOVERNMENT LICENSE RIGHTS

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to knowledge creation and distribution systems and methods, and more particularly, a system and method using software programming to create a knowledge base, organize the knowledge base or some subset thereof, and distribute the knowledge in various formats, including a tutorial.

BACKGROUND OF THE INVENTION

Organizations and companies can amass tremendous amounts of information. However, transmitting this information in a useable format, including the right subset of the information and in the proper manner, to employees or individuals in the organization is often very difficult. In order to aid in this process, numerous computer-based training, tutoring and information delivery systems have been propagated to attempt to transfer data or information to users with no external input from a human (other than the user).

These training systems generally fall under the category of "computer-based training" (CBT), which includes "intelligent computer-based training" (ICBT), "intelligent computer-aided training" (ICAT) and "intelligent tutoring" (ITS) systems. These types of training systems share the objective of presenting instructional material to a human recipient (called a "user") using a computer program with little or no additional human intervention. These types of computer-based tutorial systems have been developed to reduce the cost associated with traditional classroom training (including travel costs, salaries for instructors, and excessive lost productivity during training).

In these computer-based training systems, the computer program must initially be provided with a database of the basic information from which it can compose the instructional material (e.g., text, graphics, charts, video clips, audio clips, etc.) that is provided or built by an "author." There are two distinct concepts surrounding the delivery of information using these tutorial systems that can be categorized as follows: (1) the content detailing the concepts to be conveyed to the user and (2) the manner in which the content is to be conveyed. For purposes of this disclosure, these two concepts are termed the "content" and "pedagogy" respectively.

Traditional CBT approaches generally include "authoring tools" that allow authors to develop and deliver on-line instruction programs. These prior art CBT systems focus on integrating numerous media formats into seamless, highly scripted presentations. These CBT authoring systems require the author to completely create and specify the pedagogy. Also the content and the pedagogy are highly interconnected within the database. Furthermore, these CBT systems have only been used to deliver knowledge to a student in a tutorial paradigm.

An extension of the tutorial systems can be generally categorized as a user-model tutorial. These user-model prior art tutorial systems attempt to develop models of the user's state of knowledge prior to the tutorial. The emphasis of these approaches, including the overlay model, the bug library model, and the dynamic model computation, is on developing a student model and then using this model to determine choices in a predetermined pedagogy. However, these user-model approaches do not reduce any of the problems associated with creating the predetermined pedagogy by the author.

Another example of a computer aided training system is contained in U.S. Pat. No. 5,311,422, entitled "General Purpose Architecture for Intelligent Computer-Aided Training," which discloses a tool for building on-line training programs, including templates for content, pedagogy, and user model (i.e., model of the user's knowledge) that apply to a wide variety of domains. The tool can execute training programs using these general templates and cooperating expert system (rule-based) programs. However, these rule-based programs must be individually written for each new training application and therefore require a person skilled in the art of rule-based programming; a rare expertise when compared to traditional programming skills for languages such as C++ and JAVA. Furthermore, this patent still requires the author to create a fully-specified pedagogy (i.e., the pedagogy cannot be created automatically). Additionally, this prior art patent only discloses the delivery of knowledge to users in a tutorial paradigm (i.e., not in a help system, customer service, what-if scenario, etc.)

Another prior art training approach is virtual classroom training (VCT) which attempts to combine elements of classroom training with elements of CBT using video conference and other technologies. Typically, students are linked with an instructor in a virtual classroom using telecommunications technology and computer applications. While VCT offers some of the advantages of interaction among students and an instructor, it still has the drawback of requiring a human instructor. Additionally, these prior art VCT do not automatically generate pedagogies for the simple reason that the instructor determines how the material will be delivered. Furthermore, the initial implementation costs for VCT are extremely high and the VCT courses are not self-paced.

In all of the above-described prior art systems, the author must create and/or input a pedagogy for delivering the knowledge to the user. Therefore, during the building of the database, the author must also create the pedagogy (i.e., the manner in which the user will be delivered information from the database). In other words, the author must specify pedagogical details such as when content is to be displayed, how often it is to be displayed, whether it is optional or must be mastered prior to moving forward, etc. Furthermore, more flexible pedagogies are more desirable as they can address a greater variety of user backgrounds and skill levels, and can provide a given user with a greater variety of delivery interactions. In fact, some of these prior art tutoring systems incorporate very elaborate pedagogical specifications, including branching logic that can be based upon student inputs. However, another limitation of the prior art tutoring systems is that the greater the flexibility in the pedagogy, the greater the burden on the author who must input all the pedagogical details. This places a higher burden on either the author, the programmer creating the program, or both.

SUMMARY OF THE INVENTION

The present invention provides a dynamic knowledge creation and delivery system and method that substantially

eliminates or reduces disadvantages and problems associated with previously developed computer-based information delivery systems and methods.

More specifically, the present invention provides a system for that includes a knowledge delivery computer program stored in computer-readable form on a tangible storage medium for delivering concepts from a configuration data base to a user. An author can create the configuration data base using the knowledge delivery computer program so that the configuration includes a plurality of concepts and, optionally, a plurality of problems associated with the concepts. As the author creates the configuration, the knowledge delivery software allows the author to create a configuration taxonomy to define the relationships between the concepts. The knowledge delivery software can then automatically generate a pedagogy for the configuration based on the configuration taxonomy that defines how the concepts will be delivered to a user. The author may optionally create all or part of the pedagogy manually. The knowledge delivery software can also facilitate the delivery of the content within the configuration to a user according to the pedagogy. A user can access the configuration using the knowledge delivery software over the internet using a user interface stored on the client computer that allows the a user to send requests and receive responses over the internet.

The present invention provides an important technical advantage by separating the content to be delivered from the pedagogy or manner of delivery. Therefore, the present invention does not require any pedagogical input from the author creating the content knowledge database.

The present invention provides another technical advantage by automatically creating the pedagogy for delivering knowledge to a user. The automatic generation of the pedagogy is based on the content of the knowledge base and the taxonomy of, or relationships between, those concepts.

The present invention provides still another technical advantage by automatically generating different pedagogies from a single concept knowledge base.

The present invention provides yet another technical advantage by allowing the delivery of content from the knowledge data base in a variety of different formats using a variety of different delivery mechanisms (including the internet).

The present invention provides another technical advantage by allowing the author of the knowledge base to optionally override the automatic pedagogy mechanism to create a pedagogy that the author specifies.

The present invention provides a technical advantage because it can deliver knowledge to a user using a general architecture that is adaptable for a variety of instructional fields in addition to the traditional tutorial paradigm (e.g., in a help system environment, a customer service scenario, a what-if scenario, etc.).

The present invention provides still another technical advantage by being adaptable to create multiple concept knowledge bases, to create multiple configurations, and to provide knowledge delivery to multiple users at a time from any of multiple configurations.

The present invention provides another technical advantage by allowing for the creation and integration of a user model for every user/configuration pair that includes a history of all the elements of the given configuration presented by the invention to the user, as well as a record of the user's response to each element.

The present invention provides another technical advantage in that it does not require either the author or the user to have an understanding of neural network programming, artificial intelligence programming, or even more common programming languages such as C++ or JAVA. The present invention utilizes browser extension technology to allow both the author and the user to "point and click" to execute functionality.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings in which like reference numerals indicate like features and wherein:

FIG. **1** is a diagramatical representation of a client-server architecture incorporating one embodiment of the knowledge delivery program of the present invention;

FIG. **2** shows the interaction between an author and the configuration editor and a number of users and the tutor maker;

FIG. **3** illustrates in more detail the subprogram of the configuration editor and tutor maker of FIG. **2**;

FIG. **4** illustrates in more detail the configuration editor of the FIG. **2** embodiment;

FIG. **5** illustrates in more detail the tutor maker of the FIG. **2** embodiment;

FIG. **6** shows one embodiment of the user interface according to the present invention;

FIG. **7** illustrates in greater detail the interaction between the user and the tutor maker;

FIGS. **8–14** are schematic representations of the data structures for programming elements of the present invention for an object oriented embodiment;

FIGS. **15–27** show embodiments of various windows that can be used to impliment the knowledge delivery program of the present invention;

FIG. **28** is a flow diagram illustrating the operation of one embodiment of the present invention;

FIG. **29** is a flow diagram illustrating the operation of the configuration editor;

FIG. **30** is a flow diagram illustrating the operation of the concept editor;

FIG. **31** is a flow diagram illustrating the operation of the add/update concept function of the present invention;

FIG. **32** is a flow diagram illustrating the operation of the create concept function of the present invention;

FIG. **33** is a flow diagram illustrating the operation of the modify concept function of the present invention;

FIG. **34** is a flow diagram illustrating the operation of the problem editor function of the present invention;

FIG. **35** is a flow diagram illustrating the operation of the update problem function of the present invention;

FIG. **36** is a flow diagram illustrating the operation of the pedagogy editor function of the present invention;

FIG. **37A** is a flow diagram illustrating the operation of the pedagogy generator function of the present invention;

FIG. **37B** shows a window illustrating an automatically generated pedagogy for a sample configuration;

FIG. **37C** shows a window containing another pedagogy automatically generated accoding to FIG. **37A**;

FIG. **38** is a flow diagram illustrating the operation of the delete pedagogy function of the present invention;

FIG. **39** is a flow diagram illustrating the operation of the add/update pedagogy function of the present invention;

FIG. **40** is a flow diagram illustrating the operation of the tutor maker according to the present invention;

FIG. **41** is a flow diagram illustrating the operation of the tutor maker action handler function of the present invention;

FIG. **42** is a flow diagram illustrating the operation of the load configuration function of the present invention;

FIG. **43** is a flow diagram illustrating the operation of the load knowledge base function of the present invention;

FIG. **44** is a flow diagram illustrating the operation of the delete configuration function of the present invention;

FIG. **45** is a flow diagram illustrating the operation of the delete knowledge base function of the present invention;

FIG. **46** is a flow diagram illustrating the operation of the generate HTML function of the present invention;

FIG. **47** is a flow diagram illustrating the operation of the toolbar HTML generation function of the present invention;

FIG. **48** is a flow diagram illustrating the operation of the event handler function of the present invention;

FIG. **49** is a flow diagram illustrating the operation of the pop-up handler function of the present invention; and

FIG. **50** is a flow diagram illustrating the operation of the mode handler function of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention are illustrated in the FIGUREs, like numerals being used to refer to like and corresponding parts of the various drawings.

The present invention includes software programming to deliver knowledge to users. The knowledge delivery can occur using a variety of mechanisms including a CD-ROM on a stand-alone computer, or over an intranet or the internet. The description of the present invention will presume a client-server architecture and delivery over the internet, though any other computer-based delivery mechanism can be employed. The dynamic knowledge delivery program **100** of the present invention includes two components (each of which can be a stand alone software program): (1) software to produce a configuration and (2) the software to deliver knowledge from the configuration to the user.

For purposes of the present invention, a distinction will be drawn to two categories of information within the configuration: the "content" and the "pedagogy." The content represents the concepts to be conveyed to the user (i.e., what information will be provided the user during instruction). The pedagogy is the manner in which the information is to be displayed to the user (i.e., how the instruction will be performed). The dynamic knowledge delivery program **100** includes an automated pedagogy generator that automatically determines, based on taxonomy input by the author during the building of the configuration, how the knowledge should be delivered to the user without additional input from the author. In this way, the present invention completely separates content from pedagogy. Thus, the author does not have to develop both the content and the manner of delivery, but rather must just develop the content and the relationships among the concepts that make up the content. The manner of delivery, or the pedagogy, can then be automatically generated by the present invention. Another distinction can be drawn between categories of information contained with the "content" portion of the configuration **10**: the "descriptive content" and the "referential content". The descriptive content is the actual text, video, sound, etc. that describes a component of the configuration. For example, the description of a particular concept might include a drawing or figure and accompanying text. Also, a description of a test question might consist of the text for the statement of the question, the text for each multiple choice answer, and the text to explain the correct answer to the question. The referential content is the linkage (e.g., pointers) to the description content plus any relational linkages among elements of the referential content. Thus, a concept would refer to the descriptive content for that concept, and it would refer to any examples or test questions related to that concept. The taxonomy mentioned previously is part of the referential content of a configuration **10**.

The present invention includes dynamic knowledge delivery computer program **100** executed within a computer system **200**, such as that shown in FIG. **1**. Computer system **200** is a client/server architecture that includes the internet, and includes client computer **220**, server computer **230**, and network computer **240**. Client computer **220** connects to server computer **230** over network **210**, while network computer **240** connects to server computer **230** over network **210**. It should be understood that network **210** can be the same network or a different network in practice (e.g., the network connecting client computer **220** to server computer **230** could be the internet, while the network connecting the network computer **240** to the server computer **230** could be a company intranet). It should be further understood that a variety of other computer systems could be employed, including a single computer executing all of the client, server and network side functions of FIG. **1**.

Each computer in FIG. **1** includes a central processing unit (CPU) or processor **12** and a storage device or memory **14**. Dynamic knowledge delivery computer program **100** includes the configuration editor program **110**, the tutor maker program **120**, and the user interface **130**, each of which can reside in memory **14** (for example, random access memory or RAM) within the server computer, the network computer, and the client computer, respectively. As shown, configuration **10** can reside in file memory **15** (e.g., hard drive, floppy disk, etc.) that resides on or is accessible by server computer **230**. The dynamic knowledge delivery computer program **100** includes instructions that, when executed, cause the CPUs **12** to perform the functions described herein. In another embodiment each of the three programs could reside on a single computer that an author could access to create the configuration **10** and a user could then access in order to deliver knowledge from the configuration **10**. In yet another embodiment, dynamic knowledge delivery computer program **100** is stored in a computer readable medium of a removable computer disk, such as a floppy disk or compact disk.

For purposes of the present invention, the configuration building software is referred to herein as the configuration editor **110**, while the knowledge delivery software is referred to as the tutor maker **120**. An internet architecture such as that shown in FIG. **1** will also include a user interface **130**, which is shown to include a browser **28** and a browser extension **30**. Configuration editor **110** can include five sub-programs: the concept editor **16**, problem editor **18**, pedagogy editor **20**, tutor manager **44**, and pedagogy generator **50**, each of which will be described in more detail. It should be noted that the pedagogy generator **50** can optionally be located within the tutor maker **120**, however locating the pedagogy generator **50** within the configuration editor **110** allows an author to make pedagogical input as an alternative to the automated pedagogy generation of the pedagogy generator **50**. Tutor maker **120** can include three sub-programs, tutor manager **44**, pedagogy generator **50**, and HTML generator **36**. In both configuration editor **110**

and tutor maker **120**, a tutor manager **44** contains the concept reader **22**, the problem reader **24**, and the pedagogy reader **26**. FIG. **1** also shows configuration **10** loaded within file memory **16** on server computer **230**.

As illustrated in FIG. **2**, the interactions between the dynamic knowledge delivery program **100** and human beings occur in two phases: the first phase between an "author" **32** and the program **100** to develop the configuration **10**, and the second phase between a "user" **34** and the program **100** to deliver content from the configuration **10**. The configuration editor **110** allows the author **32** to develop configurations **10** from which content will be extracted for delivery to user(s) **34**. The tutor maker **120** allows a user **34** (or multiple users **34** simultaneously) to have content delivered to them according to the pedagogy that can be automatically generated by pedagogy generator **50**. FIG. **2** shows that any number of data configurations **10** can be built author(s) **32** from the configuration editor **110** and/or accessed by user(s) **34** from the tutor maker **120**. Each configuration can be completely independent from every other configuration. FIG. **2** also illustrates that any X number of users **34** can access any N number of configurations **10** where X does not necessarily equal N. Thus, two or more students **34** can access the same configuration **10** simultaneously using concurrent programming techniques.

Configuration **10** is the underlying data structure that consists of a concept knowledge base, and optionally a pedagogy knowledge base and a problem knowledge base. Different configurations **10** may be constructed by mixing together different concept knowledge bases, problem knowledge bases, and pedagogy knowledge bases (e.g., the same concept knowledge base can be used in multiple different configurations and multiple different tutorials). The knowledge bases are the data bases of information or "concepts" from which certain of the concepts are chosen and delivered to user(s) **34**. The term "knowledge base" is used to differentiate this data base from typical informational databases because the knowledge base incorporates a taxonomy or dependency of relationships among the concepts.

For example, a broad concept that could be included within a knowledge base could be a computer. The concept of a computer also includes sub-assembly concepts such as a keyboard, a processor, a display screen, a memory, and component concepts such as transistors, resistors, and microchips. The computer can also include concepts such as software programs and architectures such as an intranet or internet. Further concepts can include how the computer actually works using the various sub-assemblies, software and architectures. Depending on the user, different concepts from the knowledge base can be delivered using the dynamic knowledge delivery program **100** of the present invention. For a sales person, concepts such as the operation of a microprocessor to execute a program might represent too much detail, however, that might be exactly the level of detail required for an electronic technician building the computer. Thus, the dynamic knowledge delivery program **100** allows author **32** to build knowledge bases in such a manner as to allow different format and content delivery to different users **34**.

One of the unique aspects of the dynamic knowledge delivery software program **100** is that it allows the author **32** to enter into the configuration **10** not only the concepts the author **32** wants to teach or transmit to the user(s) **34**, but also the taxonomy of the concepts or the relationship among those concepts. The dynamic knowledge delivery software program **100** then leverages that taxonomy with software programming to automatically build a pedagogy based on the taxonomy.

FIG. **3** shows a more detailed block diagram of the system shown in FIG. **1**. As shown in FIG. **3**, the author **32** accesses the configuration editor **110** that includes concept editor **16**, which is used by the author **32** to make the concept knowledge base **11**, problem editor **18**, which can be used to make the problem knowledge base **13**, and pedagogy editor **20**, which can be used to make the pedagogy knowledge base **15**, and these three knowledge bases comprise configuration **10**. The tutorial manager **41** within configuration editor **110** is connected to tutorial manager **44** contained within tutor maker **120** (each of which contains the concept reader **22** (shown as part of concept editor **16**), problem reader **24** (shown as part of problem editor **18**), and pedagogy reader **26** (shown as part of pedagogy editor **26**)). As shown in FIG. **3**, tutor maker **120** includes four sub-programs which are the action handler **42**, HTML generator **36**, tutorial manager **44**, and user session **48**. Tutor maker **120** also includes tutorial database **46** and can optionally access user model **52** which is a data base modeling the user **34**. The user **34** accesses tutor maker **120** over network **210** using the user interface **130** which includes, for an internet application, a browser extension **30** and standard browser **28** (such as internet Explorer, Netscape Navigator or Netscape Communicator).

Configuration editor **110** facilitates the building of configuration(s) **10**. As shown in FIG. **3**, configuration **10** includes a concept knowledge base **11** component, a problem knowledge base **13** component, and a pedagogy knowledge base **15** component. The concept knowledge base **11** is the portion of configuration **10** that includes the concepts to be delivered to a user **34**. The concept editor **16** of configuration editor **110** is the subprogram utilized by the author **32** to input concepts into a concept knowledge base **11** and to create the hierarchy of relationships among concepts known as the taxonomy. Thus, as an author creates a knowledge base **11**, the taxonomy is created as well (i.e., as the author **34** designates the relationships among the concepts). The combination of the taxonomy and automated pedagogy generation provide an extremely flexible knowledge delivery system that does not require pre-scripting the way the information will be delivered. The descriptive content for the concepts can be created using any number of data formats (e.g., text, tables, audio, and video of all types) so long as it can be converted into a format readable by the dynamic knowledge delivery program **100**. For example, an internet client-server architecture as shown in FIG. **1** currently requires the descriptive content developed by the author **34** using the concept editor **16** to be compatible with or convertible to HTML. This allows the delivery of the content to users **34** over the internet. As the author completes the inclusion of data into the concept using the concept editor **16**, a pointer is created that will point to all of the data associated with the concept.

Furthermore, each concept is incorporated into a structure of relationships, or taxonomy, based on each concept's relationship to previously created concepts (i.e., the "referential content"). For example, suppose the concept to be learned by the user is asset allocation. The base concept would be asset allocation which would include a number of concepts that need to be taught in order to understand asset allocation. Assume that at least the concepts "time-risk tradeoff", "stocks", "bonds", "investment pools", "investment goals", "dollar cost averaging", "value averaging" and "risk tolerance" must be delivered to the user to understand asset allocation. The author **32** will use the concept editor **16** to create descriptive content for each of these concepts by placing information (again, text, video and audio) within each concept. In an internet client-server environment, each

concept would have HTML pages associated with it that contained the content. Further assume that the author **32** thinks that in order to understand "time-risk tradeoff", a person must first understand "investment goals", "risk tolerance", "dollar cost averaging" and "value averaging". Therefore, the taxonomy for the concept of "time-risk tradeoff" is that this concept depends on the "sub" concepts of "investment goals", "risk tolerance", "dollar cost averaging" and "value averaging". Each concept, as it is created by the author **32**, would receive a similar taxonomical indicator among the existing concepts. Further assume that "dollar cost averaging" is a leaf concept, or a concept that does not require any further explanation. Thus, no concepts will be designated as supporting concepts for the concept of dollar cost averaging in the taxonomy for asset allocation. However, if so desired by the author, dollar cost averaging could further depend on the concepts of "currency" and "time".

The author may use problem editor **18** to build a problem knowledge base **13** and the pedagogy editor **20** to create a pedagogy knowledge base **15**. It should be noted that the both the problem knowledge base **13** and the pedagogy knowledge base **15** are optional. The pedagogy editor **20** allows the author **32** to create some or all of the pedagogy (i.e., manner of delivery of content) based on the author's experience. However, this is entirely optional as the pedagogy generator **50** will automatically create a pedagogy based on the taxonomy of concepts input by the author **32**. For example, if the author **32** has a goal to teach asset allocation, the pedagogy generator **50** can automatically generate a tutorial for asset allocation based on the taxonomy. The pedagogy editor **20** allows the author **32** to create the pedagogy independently of the pedagogy generator **50** or to modify the a pedagogy that was automatically generated.

The author **32** may also create a problem knowledge base **13** using problem editor **18**. A problem knowledge base **13** would include examples and questions (collectively called "problems") relating to the concepts in a concept knowledge base **11**. As with the concept knowledge base, the problem knowledge base was both descriptive and referential content (wherein descriptive is the HTML for problems and referential content is the links to concepts. For example, the author **32** could have concepts in a tutorial delivered with examples as the tutorial is delivered. In a tutorial setting, an author **32** may want to test the user **34** (e.g., use of the program **100** to re-certify engineers). Thus, the author **32** could build a problem knowledge base **13** of questions using problem editor **18**. In an alternative embodiment, the problem knowledge base **13** could include a simulator program that automatically generates the descriptive content for questions and/or examples related to the concepts based on the concepts input by the author **32**. An example of such a program that could automatically generate problems is disclosed in *Automatic Student Modeling and Bug Library Construction Using Theory Refinement,* Baffes, Paul, (December 1994), which is incorporated by reference herein in its entirety.

Each of the concept editor **16**, problem editor **18** and pedagogy editor **20** can be used to later modify existing configuration **10** by adding, deleting or modifying concepts, problems, or the pedagogy. The existing concepts, problems, and pedagogy within the concept knowledge base **11**, problem knowledge base **13** and pedagogy knowledge base **15** can be accessed by the author **32** using the concept reader **22**, problem reader **24**, and pedagogy reader **26**, respectively. In the preferred embodiment, the referential content for each concept, problem, and pedagogical step within the respective knowledge bases will be software objects that are linked to other software objects. Programming the concepts, problems and pedagogical steps as objects in an object-oriented environment can simplify usage by multiple users.

For a client-server architecture incorporating a browser **28** within the user interface **130**, the descriptive content each of the concept, problem, and pedagogy knowledge bases would be written in or converted to HTML pages. For example, each concept in a taxonomy will have one or more different content HTML files associated with it, and optionally there may be problem, example and/or question HTML pages and pedagogy HTML pages associated with each concept.

In one embodiment, each configuration **10** and all of the descriptive content files associated with the concept knowledge base **11**, problem knowledge base **13** and pedagogy knowledge base **15** that comprise the configuration **10** are built under a single file directory to simplify bundling the configuration **10** and moving it (e.g., to place it on a disk). This single directory also facilitates delivery of the content of the configuration **10** over the internet because one can easily relocate the top-level directory from the network computer **240** to the server computer **230**. Once the referential content for the concept knowledge base, problem knowledge base, and pedagogy knowledge base of a configuration is loaded into RAM memory on the server computer by the tutorial manager, the descriptive content files for the configuration can be readily accessed.

Tutor maker **120** facilitates the delivery of content from the configuration **10** to the user **34**. The action handler program **42** will receive a request from a user **34** via browser extension **30** (e.g., log in) and will either process the request through the tutorial manager program **44** or the user session **48**. A user **34** will log in and request a particular topic (i.e., configuration **10**). The tutorial manager **44** will track whether the referential content of the requested configuration **10** has already been loaded from file memory **15** into RAM memory **14** by another user **34**, and if so, will not reload the topic, but will process the request from the loaded version of the configuration. The tutorial manager **44** tracks all of the pieces of configuration **10** to ensure that the tutorial manager program **44** only loads the referential content of a particular knowledge base, problem base, or pedagogy base one time. In this way, the time delay due to file access is minimized. Thus, a previously loaded concept knowledge base **11** in use by another user **34** need not be reloaded when a new request for the same concept knowledge base **11** is received at the tutorial manager **44**. Thus, the tutorial manager **44** reads the configuration **10** resident in file memory **15** in the server computer **230** and loads into RAM memory **14** the referential content of at least the concept knowledge base **11** of configuration **10** which is then used for all users **34** accessing this particular concept knowledge base **11**. All loaded files in the tutorial manager **44** are maintained in the tutorial database **46**, which is essentially a collection of pointers pointing to the HTML pages of the configuration. Thus, if multiple users **34** are viewing the same configuration **10**, the users are accessing the configuration **10** at the tutorial data base **46**, rather than directly accessing configuration **10**. The tutorial database **46** is the resident set of all configurations **10** currently being viewed by users **34**.

The user session **48** establishes a thread for each user **34**. In one embodiment, the tutor maker **120** is a single program that runs on the network that can service any number of different users **34** simultaneously. In order to keep track of the different users **34**, the tutor maker **120** uses parallel the

standard computer science concept known as "threads". A thread is the software abstraction for running a separate process which allows multiple processes to be running literally simultaneously either on a true parallel computing machine or a standard computing platform which simulates parallel processing (most modern operating systems have such simulation). A thread is created for each user **34** that logs into the tutor maker **120**. This creation of a separate thread for each user **34** allows for synchronizing actions among multiple users. The user session **48** allows synchronizing of threads to prevent loss of commands or erroneous handling of commands the user **34** inputs.

Also shown in FIG. **3** is an optional user model **52** data base that can be accessed by the user session **48**. The user model **52** is built by the user session **48** and is a historical data base of a user's interactions with the tutor maker **120**. The user model **52** could also incorporate much more complex user modeling techniques that have been developed to more precisely deliver content to the user **34**.

Each action from the user **34** goes to either the tutorial manager **44** or to the user session **48** if a user session has already been established. If a user session has not been established, the tutorial manager **44** either loads the configuration **10** requested by user, or if it is already loaded, accesses it in the tutorial database **46**. A new user session is then established and associated with the loaded or retrieval configuration, and the tutorial manager records this new association with the configuration in the tutorial database. Responses from user session **48** (based on requests from the user **34**) will be put through the HTML generator **36** to place the response in HTML format for transmission back through the internet to the browser **28** where the user **34** receives the response. At every exchange, the user **34** makes a request and the tutor maker **120** responds with the HTML. The HTML generator **36** can be a separate program or file in order to ease the incorporation of changes in HTML versions.

FIG. **3** shows automatic pedagogy generator **50** resident in the pedagogy editor **20** within configuration editor **110** and resident in the HTML generator **36** within the tutor maker **120**. However, if the pedagogy generator **50** only resides in the tutor maker **120**, the author **32** will have no access to it. Putting pedagogy generator **50** in configuration editor **110** allows the pedagogy to be automatically generated by pedagogy generator **50** and additionally modified, if so desired, by the author **32**.

The tutor maker **120** allows the presentation or delivery of content in different formats as chosen by the user **34**. Initially, the user will log in and the tutor maker **120** will provide the user a list of topics (i.e., configurations **10**). Upon choosing a topic, the user **34** is given a set of options on presentation style (e.g., standard tutorial, a question and answer session, a review, a surf/search session, etc.) In one embodiment, a custom tutorial could be presented by the tutor maker **120** based on the user's answers to a test covering the topic of choice.

The tutor maker **120** allows a user **34** to have content from the configuration **10** delivered based on the pedagogy created by author **32**. The concepts can include hyperlinks to allow a user **34** to see particular content even when the pedagogy would not automatically deliver that particular content to the user **34**. In addition, a user **34** could ask for examples on demand. The tutor maker **120** can track which examples a user **34** has seen and only show new examples, or recycle the examples based on the oldest viewed one. The user **34** can also request a test, whereupon the tutorial manager **44** will extract one or more test questions from the problem knowledge base **13**. The tutor maker **120** can score the test immediately and provide feedback on incorrect answers by calling content related to the question from the concept knowledge base **11** or the problem knowledge base **13**. Furthermore, if the user incorrectly answers a question, the tutor maker **120** can generate the related concepts and a taxonomy for that particular question. Thus, the tutor maker **120** can either progress through the topic using the standard pedagogy generated by pedagogy generator **50** or created by the author **32**, or alternatively can be directed by the user **34** through the topic in an entirely user-driven manner.

FIG. **4** is a diagram illustrating the overlap of the configuration editor **110** and the tutor maker **120**. As indicated earlier, both the configuration editor **110** on the network computer **240** and the tutor maker **120** on the server computer **230** contain a concept reader **22**, a problem reader **24** and a pedagogy reader **26** (note also that the pedagogy generator **50** can also be part of both programs, as explained previously). This allows both the configuration editor **110** and the tutor maker **120** to load a configuration **10** using the readers. In other words, in order for an author **32** to modify an existing configuration **10**, the author **32** must also read it via the concept reader **22**; likewise, if the configuration **10** will be presented to the user **34**, it must also be read. To illustrate, assume an author **32** must edit the problem knowledge base by adding a question and modifying an example. Using the configuration editor **110**, the author **52** would invoke the problem reader **24** to read the referential content for the desired problem knowledge base **13**. The author **32** could then use the problem editor **18** either to modify description content for the desired example or to modify the referential content for that example (e.g., associate the example with a different concept). When the user **34** then accesses the content for this example, it is accomplished via a call to the tutor maker **120** which invokes the action handler **42** which invokes the tutorial manager **44** which will use the problem reader **24** to load the referential content for the problem knowledge base through which the descriptive content for the example is retrieved and sent back to the user. Again note that if the user has already established a user session **48** via a previous input, then the user session itself has a reference to the referential content for the problem knowledge base to gain access to the descriptive content for the example.

The remainder of FIG. **4** shows the data (i.e., content) contained in the various knowledge bases. The configuration **10** comprises a concept knowledge base **11**, a problem knowledge base **13** (made up of question knowledge base **17** and example knowledge base **19**) and a pedagogy knowledge base **15**. The author uses the concept editor **16** to create/edit the concept knowledge base **11**, the problem editor **18** to create/edit the problem knowledge base **13** and the pedagogy editor **20** to create/edit a pedagogy in pedagogy knowledge base **15**. To better illustrate the configurations **10**, presume that an author **32** has created one concept knowledge base **11**, 25 different problem knowledge bases **13**, and three different pedagogies in pedagogy knowledge base **15** (e.g., a pedagogy for beginning, intermediate and advance users). Each triplet of the concept knowledge base, one problem knowledge base and one pedagogy would constitute a single configuration **10**.

FIG. **5** is a diagram detailing the tutor maker **120** of FIG. **3**. As shown, when the tutorial manager **44** builds a representation of configuration **10** as tutorial database **46**, concept reader **16** accesses the appropriate concept knowledge base **11**, problem reader **16** accesses the appropriate problem

knowledge base **13** and pedagogy reader **15** accesses pedagogy knowledge base **15**. FIG. **5** further illustrates the various pedagogy options open to user **34**. If user **34** simply follows the existing pedagogy created by the configuration editor **120**, the user session **48** returns responses to the user through the standard HTML generator **37** as shown in path labeled (a) within HTML generator **36**. In contrast, if user **34** decides to deviate from the existing pedagogy, the user session **48** returns responses to the user through the pedagogy generator **50**, then standard HTML generator **37** as shown in path labeled (b) within HTML generator **36**. Finally, the user **34** may opt to manually traverse the content of a configuration in which case the pedagogy generator is also bypassed via path (a).

FIG. **6** is a diagram illustrating the interaction between the user **34** and the tutor maker **120** via user interface **130**. User interface **130** comprises a browser **28** and a browser extension **30** as shown in FIG. **6**. Browser **28** can be any internet browser, such as Microsoft internet Explorer or Netscape Navigator or Communicator. It should be understood that different user interfaces **130** could be developed that do not require the use of an internet browser. However, for delivery of content to a user **34** over the internet, the use of a browser **28** within user interface **130** is the preferred embodiment. The user interface **130** extends the browser **28** with browser extension program **30** that includes an event handler **60**. An event handler **60** is a well understood computer science mechanism for allowing a user **34** to generate an event to be acted upon by another program (in this case the tutor maker **120**). The particular event handler **60** shown in FIG. **6** includes a pop-up handler sub-program **62**, a mode change sub-program **64** and an action sender sub-program **66**. As user **34** makes a request, that request goes to the event handler **60**. The three sub-programs receive the input commands from the event handler **60** and if either a mode change or a window pop-up is required for that command, the pop-up window **62** or mode changer **64** respond accordingly. The action sender **66** will transmit the command through the network **210** to the action handler **42** of the tutor maker **120**. An event can either generate an action that is sent to the tutor maker **120** by action sender **66** or the event can build directly into the browser (e.g., close a window type event).

The browser extension **30** can be built to be compatible with both currently dominant internet browsers, Microsoft internet Explorer and Netscape Navigator or Communicator, by writing the browser extension **30** in javascript, jscript, or any other compatible browser scripting language. However, it should be understood that the user interface **130** could be run with any browser by, for example, including a step for detecting which browser **28** was running on the user's machine and sending a compatible browser extension **30** for that particular browser **28**. During the operation of one embodiment of the dynamic knowledge delivery program **100** of the present invention, each time the user **34** inputs a command, the browser extension **30** is loaded (i.e., the particular Java script file that is the browser extension **30**). The browser extension **30** includes a set of functions that sit within browser **28**. Thus, whenever the user **34** inputs a command, for example clicks on a hyperlink, the browser extension **30** is called and every HTML Web page that is generated by the tutor maker **120** and sent back to the browser **28** includes a reference to the browser extension **30**. For example, the top line of the generated HTML page can included a reference to the browser extension **30**, and when the browser **30** receives the HTML page from the tutor maker **120**, the browser **28** now knows how to interpret the HTML page and reads it.

The dynamic knowledge delivery program **100** of the present invention can be programmed using C++, JAVA, or any other commonly utilized computer programming language. In the preferred embodiment for use over the internet, the programming language is JAVA to facilitate the delivery of content to a user over the internet. Another novel feature of the present invention includes, in an internet environment, the ability to access the tutor maker **120** using browser extension **30** and retrieve responses through browser **28** without actually calling different URL Web pages. This is accomplished using "script call" where the call actually sends the request for a URL over the internet to a servlet program that takes the request, generates a response in HTML format and sends the HTML page to the user's existing URL. Thus, the tutor maker **120** need not have every potential HTML file that could be a response to a user request existing as a Web page with an associated URL, but rather each HTML page response is generated upon each request and sent back to the user via the browser **28**. For example, when the user **34** logs in, a call goes to the tutor maker program **120** to generate and send back a particular HTML page that is a form that can include a login box, a password box, and a submit button. Similarly, user **34** can call the tutor maker **120** on the server computer **230** to generate all of the HTML page responses upon request.

This novel architecture also allows for delivery of a configuration **10** to a particular user **34** in a unique manner compared to typical internet applications. Assume a particular user **34** logs in and is having a particular tutorial delivered. Further assume the user leaves the computer, but remains logged on at a certain point in the tutorial. The user **34** now goes to another computer and links to the internet using a different browser **28** (e.g., uses Netscape Navigator on the second computer while the first was using Microsoft Explorer). The user **34** again logs into the tutor maker **120** on server computer **230** to view the same tutorial. The tutor maker **120** according to the present invention can determine that this user **34** is already viewing this tutorial in a different place on the internet and can send a message asking the user whether the user wants to log off the original computer and view the tutorial from the present location. If the user **34** responds in the affirmative, the tutor maker **120** will log off the first location and bring up the tutorial in precisely the place the user left off earlier. Thus, the dynamic knowledge delivery program **100** of the present invention is internet aware in that it can (1) allow multiple users to simultaneously view the same or different configurations and (2) can move the same user from a first location to a second location while maintaining the history on a particular tutorial (without the user having to save the tutorial on a disk and take it to the new physical location). This particular novel programming feature can be used in a variety of information delivery processes over the internet. For example, in an e-commerce application, a shopper could be half way through a transaction and need to change locations. The shopper could leave the first computer with the transaction half completed, log on to the same site at a different computer and continue the transaction at the same place. Essentially, this programming feature will work for any internet function that requires a user to log on.

FIG. **7** is a partial detailed diagram of the tutor maker **120** of FIG. **3** to illustrate the ability of the present invention to manage multiple users **34** viewing multiple configurations **10**. In FIG. **7**, "x" users **34** have opened user sessions **48** and have accessed "n" configurations **10**. Tutorial manager **44** has therefore labeled "n" configurations **10** into the tutorial data base **46** (i.e., by reading in the three knowledge bases

of each configuration **10**). Thus, x users **34** are accessing the n tutorial data bases **46**. For example, assume ten total users and that user number **5**, user number **7** and user number **10** are accessing the same concept knowledge base **11**. Therefore, tutorial database numbers **5**, **7** and **10** share the same concept knowledge base. However, only one instance of that particular concept knowledge base would be loaded in memory within tutorial data base **46**. Let's further assume that user numbers **5** and **7** are also accessing the same problem knowledge base, but user number **10** is accessing a different problem knowledge base. An instance of each of these separate problem knowledge bases would then be loaded in tutorial data base **46**. Thus, for users **5**, **7** and **10**, we have three user sessions **48**, two tutorial databases **46** each sharing one instance of the concept knowledge base.

FIGS. **8–14** illustrate exemplary abstract views of the data structures for some of the components of the dynamic knowledge delivery program **100**. It should be understood that the elements could include different data structures than those exemplary data structures shown. FIGS. **8–14** show the abstract views of objects developed using object-oriented programming.

FIG. **8** shows a concept knowledge base data structure **68**, which is the referential component of a concept class. The concept knowledge base is the set of concepts created by the author that will be delivered to the user. The set of concepts can be stored in a variety of standard computer science mechanisms (e.g., lists, hash tables). The concept knowledge base data structure **68** shown in FIG. **8** includes a name, a title, dependent links, supported links, views and problems links. The name is the name the author assigns the concept and the title is the way the concept appears when shown to the user (which can be different from the name). The dependent links are the references to additional concepts that this concept breaks down into, while the supported links are references to the additional concepts that this concept supports. The dependent and supported concept links represent the taxonomy created by the author when inputting the concepts. The problem links are the set of examples or questions associated with this concept, and are used to link the concept to all of its associated problems in the problem knowledge base. The views would contain references to the descriptive content associated with the concept that may be presented to the user. This descriptive content may include audio chips, text, streaming video or whatever other form of data represents the concept description. The concept view **70** is an instance of the concept class that is further illustrated to have an HTML reference (for example, a detailed view for a beginner versus a more limited view for an advanced user), and a type that is a label associated with the particular kind of view (detailed versus limited).

FIG. **9** shows a problem knowledge base data structure **72**, which is a problem class. Again, the problem knowledge base is a set of problems that can be stored as a hash table, list, etc. FIG. **9** also includes the inheritance hierarchy of the problem class to illustrate that other objects are derived from the abstract problem class **72**. As problem inheritance hierarchy **74** illustrates, an abstract problem type is either an example or a test question, where the test question is again an abstract class that is either an essay, a multiple choice question, or a true/false question. Thus, the derived classes of problem, essay, multiple choice question and true/false question are derived from the general problem class and "inherit" all of the attributes of problem class **72**, including a name, concept reference, HTML reference, and explanation. Thus, each problem has some kind of name associated with it, a pointer to the concept with which it's associated, HTML that describes it, and an explanation of the problem. The explanation data structure **76** is an instance of the problem class **72** that provides context for the explanation and an HTML reference. The multiple choice question data structure **78** is an instance of the problem class **72** that includes an answer list and the correct answer, where the correct answer data structure **80** includes a problem reference (what problem is this the correct answer for), an HTML reference (the answer) and a type (what type of answer).

FIG. **10** illustrates the abstract data structures and inheritance hierarchy for the pedagogy knowledge base. The pedagogy knowledge base inheritance hierarchy **82** shows the abstract pedagogy element class from which the pedagogy concept, pedagogy unit and pedagogy test are derived. Thus, the pedagogy element actually is a concept, a unit (i.e., a group of concepts) or a test. The pedagogy element at the start of the pedagogy is called the pedagogy root data structure **84** that has a name and it's children. Note that every pedagogy element has a reference to its parent, which would be empty if the pedagogy element was the root. For example, Concept **1** could have a parent of Chapter **1**, whereas Chapter **1** may have no parent. The pedagogy element **86** is the abstract class from which the pedagogy concept instance **88**, pedagogy unit instance **92** and the pedagogy test instance **90** are derived. Therefore, pedagogy concept class **88**, pedagogy unit instance **92** and the pedagogy test instance **90** inherits everything from the pedagogy element class **86**, i.e., the parent, plus the concept link and the view type. The concept link indicates the location of the concept within the pedagogy and the view type indicates the type of descriptive content to be retrieved from the concept to be presented to the user. Similarly, the pedagogy unit instance **92** would include the name for the unit, a reference to the children concepts contained in the unit (e.g., sections contained in a chapter), and any descriptive content (HTML) associated with the unit as a whole (e.g., an introduction to a chapter). The pedagogy test instance **90** includes the size (e.g., number of questions) and the list of concepts that are covered by the test.

Similarly, FIG. **11** shows a configuration data structure **94** that can include a name and references to the concept knowledge base, the problem knowledge base and the pedagogy knowledge base. Note that the references to the problem knowledge base and pedagogy knowledge base can be optional. FIG. **12** shows exemplary tutorial database data structure **96**, shared configuration data structure **97** and shared tutorial object data structure **98**. Because the tutorial database tracks the concept knowledge bases, problem knowledge bases and pedagogy knowledge bases, the tutorial data base structure **96** can therefore have a shared concept knowledge base link, shared problem knowledge base link, a shared pedagogy knowledge base link, and a shared configuration link. The shared tutorial object **98** is an abstract class that can work for any shared knowledge base. Thus, the shared concept, problem, and pedagogy knowledge bases can all include an object reference, valid flag and a count. If the count goes to zero (i.e., no instances of a shared object are open), the object can be closed. The next time a user wishes to access that object, it must be loaded into the tutorial database **46**. Similarly, the shared configuration can include all of the properties of the shared configuration abstract class **97**, including a name, the triplet comprising the configuration, a valid flag, and a count.

FIG. **13** shows exemplary user session data structure **102** and the user data structure **104** associated with it. As shown, the user session **104** includes an expiration time, a session ID, and a reference to the associated user data structure **104**

which has a user ID, a user model reference and a shared configuration reference. The session ID is the unique ID assigned to that particular session. This unique ID enables the program **100** to determine that a request from a user is associated with a particular session. The user reference includes the information about the user, including in this example the user's ID, any user model that has been built for this user, and any shared configuration the user is viewing. FIG. **14** shows a user model data structure **106** which contains lists of user model element data structures **108** (that includes a count, the last time viewed, and a name). As elements of the configuration are displayed to the user, user model element data structures are created and stored in the user model **106** The user model data structure **106** further includes any historical information about the user that is recorded by the dynamic knowledge delivery program **100** (exemplary data shown in FIG. **14**). The saved test instance **112** of the user model class **106** can be used to save previous test scores of a user, and as shown includes the question links and the answer array.

FIGS. **15–27** show exemplary windows of the dynamic knowledge delivery program **100** of the present invention. The windows are taken are exemplary and can be created using any visual editor software program, including, for example, Visual Cafe. FIGS. **15–21** show exemplary windows for what the author sees on the authoring side (i.e., configuration editor **110** side), while FIGS. **22–27** show exemplary windows for what the user sees on the delivery side (i.e., the user interface **130** and tutor maker **120** side). As indicated in FIGS. **22–24**, the windows can be generated on either a Netscape or Microsoft browser, or alternatively, without a browser for a non-internet application of the present invention.

FIG. **15** shows a configuration editor window **114** that could be used to initiate configuration editor **110** of FIG. **3**. The configuration editor window **114** allows an author **32** enter a configuration file location ("D:\TutorMaker\tutorials\test.cfg") into the config. file path field. The configuration editor window **114** also allows the user to access the concept editor **16**, the problem editor **16** and the pedagogy editor **20** using the concept editor button **116**, the problem editor button **118** and the pedagogy button **122**, respectively, in order to create and/or edit the concept, problem, and pedagogy knowledge bases. FIG. **16** shows the concept editor window **124** that can come up on the author's network computer **240** upon clicking the concept editor button **116** of FIG. **15**. Concept editor window **124** can list all of the concepts (i.e., concept **1** through concept **6**) contained in the configuration **10** chosen in FIG. **15**. As shown, concept **3** is highlighted using the cursor and the right hand portion of the window lists a summary of the concept information for concept **3**. Concept **3** has a name (concept3), a title (Concept Three), a taxonomy (concept **3** depends on concept **2** and supports concepts **4** and **6**), a summary file summarizing concept **3** (sumthree.html) and a detailed file (three.html) providing all of the information the author input about concept **3**. The content of concept **3** can be modified by clicking on the "Edit" button **126** or deleted entirely by clicking on the "Delete" button **132**.

A new concept can be added to the configuration **10** by clicking on the New button **128** and creating the concept using the OneConceptDialog window **136** of FIG. **17**. Similarly, clicking on the show hierarchy button **134** will result in bringing up the ConceptHierarchy window **138** of FIG. **18**. If the author is creating a new concept, the OneConceptDialog window **136** will look as it does in FIG. **17** (i.e., without any information in the fields). If the author is editing an existing concept, the existing information for this concept would show up in the fields. As shown in FIG. **17**, the author can give the new concept an identifier in the name field **142** and full name in the title field **144**. The OneConceptDialog window **136** then allows the author to input the location of a summary HTML file in field **146** and/or the location of a detailed HTML file in field **148**. Taxonomy fields **152** provide the important function of allowing the author to indicate the relationship between the new concept being added and existing concepts in the configuration **10**. For example, if new concept **7** depends on concept **6**, that can be entered into taxonomy field **152**. The ConceptHierarchy window **138** of FIG. **18** shows a hierarchy tree **142** of the relationship (or taxonomy) between the concepts in configuration **10**. For example, the hierarchy tree **142** shows that concept **3** depends on concept **2** and supports concept **6**. As shown, concept **3** supports both concept **6** and concept **4**.

FIG. **19** shows an exemplary problem knowledge base window **144** that is brought up by the dynamic knowledge delivery program **100** when the author clicks on the problem editor button **118** of FIG. **15**. An author can use problem knowledge base window **144** to create and/or edit problems for the selected configuration **10** of FIG. **15**. As shown in FIG. **15**, HTML file field **146** shows the HTML file that contains all of the problems, examples and questions related to the chosen configuration **10**. Field **148** allows an author to select any concept within configuration **10** from a pull-down list of all the concepts in the associated concept knowledge base. The program **100** can then list all of the problems, examples and questions that the author entered into problem knowledge base for that concept in field **154**. Highlighting a particular problem, for example question **41** as indicated in FIG. **19**, causes the program **100** to display the information related to that problem on the lower, right side of the problem knowledge base window **144**.

FIG. **20** shows the PedagogyEditorDialog window **156** that is generated when an author clicks on the Pedagogy Editor button **122** of FIG. **15**. The pedagogy name field **158**, indicates the name of the pedagogy for the configuration **10**. The concepts field **162** lists all of the concepts contained within the concept knowledge base for the configuration **10** of FIG. **15**. FIG. **20** illustrates a way to manually add concepts to a pedagogy and to show the hierarchy using buttons **164** and **166**, respectively. When adding a concept using button **164**, the add view options box **168** allows the author to add the concept in either detailed or summary form. By adding or deleting concepts, the author can manually generate or edit the pedagogy of pedagogy box **160**.

The author can also automatically generate a pedagogy (that will be displayed in pedagogy box **160**) by clicking on the auto generation button **150**, which can pull up the Auto Pedagogy window **170** of FIG. **21**. In an alternative embodiment, the pedagogy can be automatically generated as the author inputs concepts into the configuration. The Auto Pedagogy window **170** will show a list of all the concepts in configuration **10** of FIG. **15** in field **172**. The author can then choose the goal concept (i.e., the concept to be taught or conveyed) and which concepts are prerequisites (meaning once that concept has been explained, no further concepts that support a prerequisite concept need be explained). As shown in FIG. **21**, the author has chosen concept **1** as the goal concept and concepts **5** and **6** as prerequisite concepts, and the program **100** has placed them in goal field **174** and prerequisite field **176**, respectively. In computer science, a "graph" is a general term for any collection of linked objects. The concept knowledge base **11**

is a graph built based on the taxonomy of the concepts. The strategy field **178** allows the author to designate the manner in which the graph is traveled between the chosen goal and prerequisites (shown as a "bottom-up" strategy). When the author clicks on the generate pedagogy button **180**, the pedagogy generator **50** will automatically generate a pedagogy based on the strategy indicated. In FIG. **21**, the strategy, goal and prerequisite indicators tell the pedagogy generator program **50** to start with the goal, end with the prerequisites or an end concept (no supporting concepts), and pick up every concept in between the two.

FIG. **22** shows an exemplary Tutor Maker Login window **182** that includes a username field and a password field to allow the user to log in to the tutor maker program **120**. After a successful log in, the tutor maker **120** will generate a Configuration Selection window **184** (shown in FIG. **23**) that allows the user to select a configuration **10** by typing the configuration name in field **188** (alternatively, a pulldown menu of all configuration names can be accessed through pulldown button **188**). After user **34** has selected a configuration **12** by clicking on the continue button **190**, the Presentation Style window **192** of FIG. **24** is generated for the user. The presentation style window **190** includes a list of option circles **192** that allow the user to select the presentation format for the configuration **10**. As shown in FIG. **24**, the user **34** has selected a standard tutorial format for presentation of the configuration **10**. The present invention allows the generation of different presentation formats by its novel concept of completely separating the pedagogy from the content.

Upon clicking the continue button of FIG. **24**, the tutor maker **120** will generate a Tutorial Main Frame window **194** as shown in FIG. **25** if a "Standard Tutorial" is selected or an Index Selection Page window **206** as shown in FIG. **26** if a "Surf/Search" selection is made. FIG. **25** is an example of a configuration **10** presented in standard tutorial format with a series of user control buttons on a user control button bar **196** that allow the user to further control the manner of presentation. The content box **198** is where the actual content created by the author is delivered to the user. The table of contents box **202** shows a listing of the concepts which corresponds to the pedagogy. The underlined concepts within the table of contents box **202** indicate hypertext links to the content associated with the underlined concept. The indicator triangle **204** shows the user where within the pedagogy the displayed content of window **198** is located. The control buttons on the user control button bar **196** allow the user to navigate the pedagogy and bring up different content pages. The control buttons can be automatically enabled and disabled as the user navigates the pedagogy. For example, sometimes the "example" button is turned off because no example exists for the concept being displayed in concept box **198**. In alternative embodiments, the user control button bar **196** will contain different control buttons for presentation styles.

FIG. **26** is an example of a configuration **10** presented in a surf/search format which can be derived either by selecting "Surf/Search" while at the Presentation Style window **190** of FIG. **24** or by clicking on the "view" button of the Tutorial Main Frame window **194** of FIG. **25**. FIG. **26** shows an index of all of the concepts for the configuration **10** available to the user in alphabetical order. The underlining indicates the concepts have hypertext links to the content associated with the concept. FIG. **27** shows a Surf Page window **208** that is produced when the user selects "Asset Allocation" from a surf/search index contained on an Index Selection window **206** as shown in FIG. **26**. The user can now see the content associated with the concept asset allocation in the content box **198** and can link to concepts that are supported by the concept asset allocation in supported concept box **212** and/or concepts that support the concept asset allocation in sub concept box **214**. Upon clicking on any of these supported or supporting concepts, the content associated with that topic will pop up in a similar Surf Page window **208**.

FIGS. **28–52** are flowcharts illustrating the operation of the dynamic knowledge delivery program **100** of the present invention. FIG. **28** is an overview flowchart of the dynamic knowledge delivery program **100**. At step **216**, the operation is begun with the author accessing the configuration editor **110** to create one or more configurations **10**. The author stores the configurations **10** on the server computer **230** at step **218**. The user initiates the tutor maker program **120** on server computer **230** using browser **28** on client computer **220** and accesses tutor maker **120** through network **210**. At step **226**, tutor maker **120** is executed by server computer **230** to download browser extension **30** to user's client computer **220**. The user now has access to the tutor maker **120** and can now query tutor maker **120** as shown by the loop of steps **228** to **242**. After making a query, the tutor maker **120** determines whether a pedagogy exists for the query. If not, the tutor maker **120** creates a pedagogy using pedagogy generator program **50** at step **236**. The tutor maker **120** then reads the pedagogy and generates HTML for the pedagogy based on the user query and returns the generated HTML to the user over the network at step **242**. This loop repeats itself until the user query is an exit query at step **232**, whereupon the process is complete.

FIG. **29** is a flowchart of the operation of the configuration editor program **110** of FIG. **4**. The configuration editor program **110** allows the author to select one of the concept editor **16**, the problem editor **18** or the pedagogy editor **20** at step **244**. Depending on which editor is selected, the configuration editor **110** calls the appropriate editor as shown in step **246**. FIG. **30** shows the operation of the concept editor **16**. Initially at step **248**, a menu selection is made by the author. The menu selections of FIG. **30** are delete concept, edit/add concept, save, open, new, and exit. The concept editor includes the new, open, and save functions to allow an author to create, load and save a concept knowledge base, respectively. Once a concept knowledge base has been opened or created (or saved) at steps **252**, **254** or **256**, the concept editor sends the author back to the menu selection where that author can command the concept editor **16** to add/edit a concept at step **258** (more fully described in FIG. **31**) or delete a concept at step **260**. To delete a concept, the concept editor **16** will check to see if the concept has supported links at step **262** and if it does, will return a "not valid" message to the author to prevent the deletion of supported concepts. For example, looking at the hierarchy of FIG. **18**, the concept editor **16** would send a "not valid" message in response to a request to delete concept **4** because concept **4** is supported by concepts **3**, **2** and **1**. To delete concept **4**, concepts **3**, **2** and **1** must first be deleted, or the dependencies upon those concepts must be removed. In the alternative embodiment, the concept editor **16** could simply ask the author whether the author desires to delete concept **3** and all supporting concepts to which the author could answer "yes" and concepts **4**, **3**, **2** and **1** would be deleted or concept **4** would be deleted and the dependencies removed. If the concept to be deleted does not have supported links, the concept editor **16** will delete the concept from the concept knowledge base (step **264**) and will remove all links to this deleted concept (step **266**). The concept editor will continue to perform the delete, add/edit, save, open or new functions until the author selects the exit function at step **268**.

It should be noted that the interface to the configuration editor **110** described in FIG. **30** may be implemented in any of a variety of ways which support a menu selection mechanism. This includes using the same browser extension techniques described for the tutor maker **120** whereby any standard browser may be extended to implement the interface. More specifically, the techniques outlined herein for the browser extension program **30** may be readily applied on the network computer **240** of FIG. **1** to implement the interface for the configuration editor **110**.

In addition, the interface to the configuration editor **110** may be extended to allow for the operation of multiple authors simultaneously developing the same configuration **10**. This may be achieved by a simple modification to FIG. **30** wherein every element of the configuration **10** (i.e., all structures described in FIG. **8**, FIG. **9** and FIG. **10**) are given an additional boolean "in-use" flag which is set to "true" any time that element of the configuration is being modified. With this additional boolean value, step **248** may be modified to first check the indicated element of the configuration **10** that is to be modified to see if its "in-use" flag is set. If so, the menu selection is disallowed. If not, the menu selection is allowed and the in-use flag is immediately set to "true." Once the author completes the operation and returns back to step **248**, the in-use flag of the configuration element which was modified in the previous cycle is set to "false" allowing other authors the opportunity to modify that element of the configuration **10**.

FIG. **31** illustrates the operation of the concept editor **16** when adding or editing a concept. At step **268**, the concept editor retrieves the concept name, the concept title, the dependencies to the concept and HTML references for the concept from the dialog box **136** of FIG. **17**. At step **270**, the concept editor **16** determines if the concept name exists in the concept knowledge base. If so, the concept editor **16** calls the modify concept function of FIG. **33**; if not, the concept editor **16** calls the create concept function shown in FIG. **32**. Both of these operations update the concept instances and then store them back in the concept knowledge base at step **276**. FIG. **32** shows the operation of creating a concept, including assigning the concept a name, title, and an HTML location using data from the dialog box of FIG. **17**. The concept editor **16** then determines if there are any dependent concepts at step **280** (from the information in the dialog box **136**) and, if not, goes to step **276** of FIG. **31** and adds the concept to the concept knowledge base. If there are dependencies for the new concept, the concept editor **16** first determines if the dependent concept already exists within the concept knowledge base at step **282**. If not, the concept editor calls the create concept function at step **272**. If the dependent concept exists in the concept knowledge base, concept editor **16** adds the dependent concept to the dependent links of the concept being created and adds the concept being created to any supported links of the dependent concept at steps **284** and **286**. After step **286**, the concept editor **16** returns to step **280** to determine if any more dependencies exist until all dependent concepts are in the concept knowledge base and all dependencies are linked.

FIG. **33** shows the operation of editing an existing concept where the initial steps **278** through **286** are the same as creating a concept shown in FIG. **32**. At step **288**, the concept editor **16** takes the additional action of determining if the modification of the concept resulted in the deletion of some dependencies. If so, at step **290**, the concept editor removes any dependent concepts from the concept dependent links and removes concepts from any dependent concept supported links. For example, if ten dependencies existed before the modification of the concept and all ten were deleted during the modification of the concept, then the set of old pointers which linked the modified concept to the ten dependent concepts would be removed, and each of the ten dependent concepts would have its supporting link back to the modified concept removed.

FIG. **34** shows the operation of the problem editor **18** that the user initiates by clicking on the problem editor button **118** of FIG. **15**. Again, at step **292**, the user makes a menu selection that causes the problem editor **18** to perform a function on the menu, shown as delete, edit, save, create or load a problem knowledge base, until the selection is "exit" at step **294**, upon which the problem editor **18** closes. At step **296**, the problem editor **18** can load problem knowledge base by parsing the problem knowledge base using Backus-Naur Format (BNF) and calling the update problem function (FIG. **35**) to save each parsed problem. In the preferred embodiment, a problem knowledge base is a single HTML file (rather than separate HTML files for every single example, problem and question). In order to be able to later separate the individual problems, questions and examples from one another, the ones related to a particular concept must be parsed out from the problem knowledge base HTML file. In one embodiment, the BNF definition (i.e., syntax, grammar and semantics) for parsing the problem knowledge bases is as follows:

BNF for the Syntax for Problem Delimiters

"( )"	indicates a grouping of items. If '|' is present, then exactly one of the items is to be selected.
"{ }"	indicates a list. Repeat pattern with { } 0 or more times if "*" is used; repeat 1 or more times if "+" is used.
"[ ]"	indicates an optional item
"--"	indicates a comment

uppercase is for non terminals lowercase is for terminals (also, items enclosed in single quotes are terminals).

EXTRA-SYNTACTIC RULES:

1. TUTORFILE commands can appear within any general HTML file.
2. Attributes of an HTML element (including DIV) can appear in any order. This applies to QUES-HEAD, EXAM-HEAD, EXPL-HEAD and CHOICE-HEAD.
3. White space must SEPARATE attribute/value pairs in an HTML element (see note 2 above). There can also be optional white space before the final '>' of an HTML element.
4. White space is optional between elements in HTML. This applies to productions QUESTION, EXAMPLE, EXPLANATION and CHOICE below.
5. All attribute/value pairs, e.g. id="t1", can have WS around the "=", and can enclose the value in either " " or ' ' or use no quotes at all (if no quotes are used, then no WS may occur around the "="). Below, we show all attribute values enclosed in " ". This applies to the ID, CONCEPT, TYPE and CONTEXT productions below.

TUTORFILE ::={ COMMAND }* -- optional white space between commands

COMMAND ::=(QUESTION | EXAMPLE)

QUESTION ::=QUES-HEAD HTML::=[EXPLANATION] {CHOICE}+ DIV-END

EXAMPLE ::=EXAM-HEAD HTML [EXPLANATION] DIV-END

EXPLANATION ::=EXPL-HEAD HTML DIV-END

CHOICE ::=CHOICE-HEAD HTML DIV-END [EXPLANATION]

QUES-HEAD ::='<DIV' 'class="question"' ID TYPE CONCEPT '>'
EXAM-HEAD ::='<DIV' 'class="example"' ID CONCEPT '>'
EXPL-HEAD ::='<DIV' 'class="explanation"' [CONTEXT] ['override'] '>
CHOICE-HEAD ::='<DIV' 'class=choice"' ['correct']'>' -- note that only CHOICE-HEAD for a group of CHOICEs -- for a given QUESTION may be marked 'correct'.
ID ::='ID="' IDENTIFIER '"'
CONCEPT ::='concept="' IDENTIFIER '"
TYPE ::='type="mc"' -- eventually, more types
CONTEXT ::='context="' IDENTIFIER {WS IDENTIFIER}* '"' -- note there MUST be white space between identifiers -- here (i.e., they are white space separated).
DIV-END ::='</DIV>'
IDENTIFIER -- alpha numeric, also may have '-' and '_' -- but NO white space
HTML -- any HTML text, including no text (empty)

As the problem knowledge base is parsed, each problem is translated into a corresponding problem data structure **72** (see FIG. **9**). The update problem function of FIG. **35** shows that the problem editor **18** reads a problem to determine if it is a new problem at step **322**, and if so retrieves the type of problem (i.e., multiple choice question, etc.) and builds the type class for the problem at step **326** with the name, concept reference, HTML reference and explanation passed to it as parameters. If the problem is not new, then the problem editor **18** retrieves the existing problem, removes it and replaces it with the new updated problem at step **324**. At the last step **328**, the problem editor **18** ensures every problem is associated with a particular concept by searching the concept knowledge base to fill in any links to concepts that are missing. This provides the links between the problems and the concepts to which they relate.

With reference to FIG. **34** again, the new selection **300** and save selection **304** cause the problem editor **18** to create an empty problem knowledge base (step **302**) or to save a problem knowledge base (step **306**), respectively. If the user selects edit at step **308**, the problem editor **18** allows the user to load a problem HTML file into an HTML editor at step **310** to edit the problem. The problem knowledge base is then updated by parsing the output of the HTML editor to place the problem in the proper format and by calling the update problem function as previously described.

FIG. **36** shows the operation of the pedagogy editor **20** that a user can initiate by clicking on the pedagogy editor button **122** in the configuration editor **114** of FIG. **15**. That operation can bring up the pedagogy Editor Dialog window **156** of FIG. **20** to allow an author to create or modify a pedagogy (manually or automatically). The Pedagogy Editor Dialog window **156** can include a pull-down menu or individual buttons that allow a user to activate the functions of FIG. **36**. In the embodiment shown in FIG. **36**, the menu selection includes save, load, new, auto generate, edit/add and delete functions. As shown, the performance of any of the steps returns the author to the menu selection **330** to perform any of the other functions and, after any combination of these, the author can exit at step **332**. Steps **334**, **336**, and **338** allow an author to load an existing pedagogy from a storage location, create a new pedagogy by linking concepts in any chosen manner, and to save a pedagogy for a particular configuration, respectively. At step **340** the dynamic knowledge delivery software **10** can automatically generate a pedagogy. The initial step **342** can include the option of allowing the user to select a generation type. The generation type is the method of presenting the concepts based on the taxonomy. For example, the generation type might be a bottom-up or top down or some other relational pattern. The user can also optionally select the generation parameters at step **344** which will set the goal and the prerequisites. The dynamic knowledge delivery program **100** will then call the autogeneration routine that will arrange the concepts based on the generation type and the goal (start) and prerequisites (end) at step **350**, as shown in FIG. **37**. Finally, the resulting pedagogy is added at step **352**. The edit/add step **354** calls the edit/add function **360** of FIG. **39**, while the delete function at step **356** calls the delete function **370** of FIG. **38**.

FIG. **37A** shows the operation of the Pedagogy Generator function that occurs upon the author's selection of the auto generator button **150** of FIG. **20**. As shown in FIG. **37A**, at steps **362** and **364** pedagogy generator **50** sets the goal concepts and prerequisites that were selected or passed in (e.g., as described in FIG. **36**). The goal concepts and prerequisite concepts must be chosen (either manually by the author or automatically by the dynamic knowledge delivery software) to allow the generation of the pedagogy. At step **366** the pedagogy generator **50** determines whether the context concepts were specified and, if so, adds the context to the prerequisites concepts at step **368**. This is an optional step where, if the user or author has specified particular concepts types only to be delivered, the pedagogy generator **50** will only search on those particular concepts types within the concept graph and only those particular concept types will be included in the resulting subgraph of concepts to be delivered to the user. If the author is creating the pedagogy, then the author chooses the type. If the TutorMaker is generating a pedagogy for a response to the user, then it can be based on the user's type (i.e., if user technical vs. salesman etc.) This essentially operates as another type of prerequisite. The concepts have been labeled with these "type" labels in the concept knowledge base. At step **370** the pedagogy generator **50** then collects the subgraph of concepts according to a searching algorithm incorporated into the pedagogy generator **50**. The collection of the related concepts as a subgraph can be done by recursive descent (e.g., depth first, breadth first, stopping at concepts that have no children, stopping at prerequisite concepts or prerequisites based on user's background, etc.). At step **372**, the concepts within the collected subgraph are ordered based on the generation type selected by the user or programmed into the pedagogy generator **50**. Optionally, the searching and traversing of the graph can also be guided by parameters included from a user model that is accessed prior to searching the graph.

As noted, the pedagogy generator **50** includes a graph searching algorithm that navigates, according to the type of algorithm, the graph of concepts that is based on the taxonomy. Any graph searching algorithm can be used in the present invention. A "graph" is a standard computing term for a series of linked nodes, that are typically acyclic for the present invention (i.e., the graph does not wrap back around on itself), where each node represents a concept. The links are connected to one another according to the relationship of each concept to every other concept (i.e., the taxonomy).

Graphs are typically represented so that upper nodes are parents, lower linked nodes are children of the parent nodes, and nodes on the same level are sibling nodes. The pedagogy generator **50** sets the goal concept node as a starting node and the prerequisite concept nodes as ending points and uses the graph searching algorithm to search the graph using its designated method. For example, one method is a depth first search that requires the search to go from parent to its child

(if multiple children, to a particular child based on its location in the graph), to its child, until no more children are reached, and then back to the upper-most node that has other children not searched, and repeats until all nodes have been searched. Another searching method is a breadth first search which requires the search to start at a parent node, search all siblings of that parent node first, and then go to the first parent node and search all of its children. Basically, the pedagogy generator uses a starting point (the goal concept), ending points (the prerequisite concepts), and a generation type to define what search method to use to create a pedagogy by traversing through the graph of concepts and ordering the presentation of concepts based on the order each node (or concept) is encountered during the search. The graph was built in the concept editor based on the relationships defined between the concepts as the concepts were entered.

Essentially, the pedagogy generator **50** traverses the graph of concepts for a particular configuration and collects a subgraph of the concepts based on the goal, prerequisite and generation type parameters. This subgraph is the pedagogy that defines what concepts will be presented and in what order the defined concepts will be presented to the user. Thus, the pedagogy generator **50** will automatically select both the relevant concepts to display and the appropriate order in which to display them based on the dependencies and relationships of the associated graph.

To further illustrate the sorting performed during automatic pedagogy generation function described in FIG. **37A**, FIG. **37B** shows an exemplary configuration delivery **374** having a pedagogy that was automatically generated based on the taxonomy of FIG. **37C** (for the six concepts in the example configuration **376**). FIG. **37C** shows that the author assigned the hierarchy or taxonomy **378** among the six concepts in the configuration **376** (using the configuration editor) as follows: concept **6** depends on concepts **3** and **4**; concept **3** depends on concept **2**; concept **4** depends on concepts **3** and **1**; and concept **6** depends on concepts **3**, **4** and **5**. FIG. **37B** shows the pedagogy automatically created based on the FIG. **37C** taxonomy based on a goal concept of concept **6** and no prerequisite concepts (i.e., include every concept in the configuration). The steps of FIG. **37A**, the pedagogy generator **50** will generate the pedagogy that is presented in FIG. **37B**. The pedagogy of FIG. **37B** shows that in order to explain/understand concept **6**, concepts **3**, **4** and **5** must be explained in that order. In order to explain concept **3**, concept **2** must be explained. In order to explain concept **4**, concept one must be explained, and then concept **5** is explained. At this point, all of the prerequisites to concept **6** have been explained and concept **6** can be delivered. As shown in FIG. **37B**, concept **4** can include again concept **3** with its supporting concept **2** in summary form. FIG. **37B** illustrates a "bottom up" generation type of delivery format (e.g., prior to the explanation of a higher level concept such as a computer, the user must first have delivered an explanation of a set of lower level concepts such as transistors and software programs).

FIG. **38** shows the operation of the delete element in the pedagogy function that allows an author to delete a subsection within a tutorial delivery. For example, if the author wants to delete concept **2** from the Unit Explaining concept **3**, the author can delete concept **3** from that unit, or even delete the unit entirely. In step **382**, the configuration editor **110** can first query whether the pedagogy element to be modified is a "unit" (i.e., a set of concepts versus a single concept). If not, the program allows the author to delete the pedagogical element (i.e., concept) at step **384**. If so, at step **386**, the configuration editor **110** can query whether the entire unit should be deleted or just some subset of concepts within the unit. If the entire unit is to be deleted, the configuration editor **110** can further query whether the children concepts of the concepts to be deleted are also to be deleted and can delete them again at step **384**. This involves searching the pedagogy and grabbing all of the supported concepts (or children). If the entire unit is not to be deleted, then the parent concept of all the children concepts are set to the unit's parent concept at step **390** prior to deletion at step **384**. This effectively adds the children concept to the unit which enclosed the deleted unit.

FIG. **39** shows the add/update pedagogy function **380** that allows concepts to be added to a pedagogy by the author. The configuration editor **110** first queries whether the pedagogical element is a new element (i.e., to be added) at step **392** to determine whether the element already exists in the pedagogy. If so, then the parent of the pedagogy element is set as shown in FIG. **10** at step **394**. The configuration editor **110** then queries whether the new element is a concept at step **396**. This is included because if a concept is added, it should be linked to its parent concepts if applicable. If the element is a concept, then a link and view type is set for that concept at step **400** and the function is complete. The configuration editor **110** then queries whether the new element is a problem concept at step **400**, and if so, sets the problem size and view type at step **404**. If the new element is not a concept or problem, then it is a unit and the unit name and optionally the HTML reference are set at step **406**.

FIGS. **40** through **50** relate to the tutor maker **120** and the user interface **130**. FIG. **40** shows an exemplary flow diagram of the operation of the tutor maker. Upon start-up, the tutor maker **120** first runs an initialization phase to initialize various parameters that can include the configuration default directory, session timeout, an empty session database and an empty tutorial database at step **410**. In one embodiment, the tutor maker **120** can track where all the configurations **10** using a default directory that will contain all of the accessed configurations **10**. The timeout feature simply defines how long user's can access a configuration without initiating an action before the session will be automatically terminated by the tutor maker **120**. Further, each time a user logs into the tutor maker **120**, the user gets a user session. The tutor maker **120** then initiates a low priority thread at step **412**. The thread is an independent program that will automatically remove stale user sessions. The low priority option means that the thread will only operate when all users have been currently served with all their current outstanding requests. Finally, at step **414**, the tutor maker **120** calls the action handler **42**. which then waits for an action to come in from the user over the internet or network.

FIG. **41** shows a flow diagram outlining the action handler **42** functionality for one embodiment. At step **416**, action handler **42** waits for an action to come in from the user over the internet or network and gets the information from the request at step **418**. Each request is paired with a unique identifier (called a "cookie" for the internet). Part A of FIG. **41** indicates the action handler **42** synchronizing on a user session database. If the action handler **42** is able to locate a user session database associated with the received cookie at step **420**, the action handler moves to part B (which describes the synchronization on a particular user session). The synchronization is a standard computer science techniques used in concurrent programming to prevent deadlock problems that arises when two or more users attempt to simultaneously access the same data. In part A, the tutor

maker **120** provides for synchronizing on the user session database to lock that user session database prior to determining if the cookie is associated with a particular user session. Thus, if the user session database is associated with a session in the cookie at step **420**, then go to part B and synchronize with the session at step **430**. If not, then the tutor maker **120** will check to see that the user is a valid user and authenticates the user at step **422**. If the user is authentic, then the action handler **42** creates a new user session with a unique ID, a new user object with the session (as shown in FIG. **13**) at step **424**. This creates the user session and inserts it into the user session database. The configuration is then selected at step **426** and the action handler **42** sends the session ID back to the user over the network at step **428** (e.g., as a cookie for an internet application). The action handler **42** is now once again in a ready state to receive a request.

For requests that are for an existing user session, prior to performing the action, the action handler must synchronize on the existing user session at step **430**. The action handler **42** will return actions at step **428** until the user requests a logout and at step **434** the action handler **42** logs off by deleting the shared configuration **10** at step **436**, optionally saving the history of actions for the user session at step **438**, marking the session as invalid for removal at step **440** (this simply marks it to be cleaned up by the low priority task that was previously initiated), and generating a message HTML indicating the session has been terminated at step **442**.

For an established session, a user either selects a configuration at step **444**, relocates from one configuration to another at step **446**, or takes a tutorial action in a configuration at step **448**. If the user selects a configuration (i.e., the user is logged in but has not yet selected a configuration), the action handler **42** retrieves the configuration **10** (step **450**), determines whether a user ID and configuration pair exists (step **452**), and if so, generates a relocation HTML because the user was already viewing the configuration from another location. This HTML asks the user if they want to relocate the user session. In this manner the configuration in use by the user at the different location can be terminated and restored at the new location. The dynamic knowledge delivery program **100** can also include the capability to lock out a user on the tutor maker side at server computer **230** from accessing a particular configuration **10** if that configuration **10** is in use by an author on the configuration editor side at network computer **240**. The dynamic knowledge delivery program **100** can recognize automatically that an update is being performed by the author to the configuration on the configuration editor side changed and, therefore, locks out the internet or network side so that a user cannot access a configuration being updated. This locking is achieved by creating a temporary file called a lock file in the directory where the configuration resides. Before allowing access to a configuration, the directory is checked to see if a lock file is present. If not, access is granted and a lock file is created. Once the configuration file is no longer needed the lock file is deleted.

If the user ID/configuration pair does not exist, the load configuration function **480** is called at step **456** and the configuration is loaded as described more fully in FIG. **42**. The action handler **42** then generates the main display HTML associated with the configuration chosen at step **460**.

If the user is simultaneously logged on, the user answers the relocation prompt (see step **460**) at step **446**. If the user does not want to relocate the user session, the action handler **42** responds to the user with the configuration selection HTML at step **462**. If the user does want to relocate, the action handler **42** calls the delete configuration function **500** at step **464** to delete the configuration that is active at the other location (more fully described in FIG. **44**). The action handler **42** then performs very similar functions as when the user logs-out of saving the history at step **466**, mark the session for removal at step **468**, optionally save the user's history at that session, and creates a new user session with a unique ID and user object session (step **470**). In other words, the action handler **42** deletes the old session, makes a new one, and loads it by calling the load configuration function **480** (shown in FIG. **42**). The action handler then generates the main display HTML for the loaded configuration. The loaded configuration will include all of the user history from the old session so that the user is looking at the configuration at the same state the user left it at the other location.

For any other tutorial action (e.g., moving through a configuration) at step **448**, the action handler **42** receives the requested action, retrieves the user's session at step **476** and then retrieves the pedagogy example, or test question, or calls the generate pedagogy function, etc. and then generates the HTML and returns it as a response at step **478**.

FIG. **42** illustrates the load configuration function **480** that first queries whether the configuration has previously been loaded by an user at step **482**. If it has, then the tutor maker **120** retrieves the shared configuration object from the tutorial database **46** at step **484** and increases the shared configuration (SC) increment count by one at step **486**. If the configuration is not in use, the tutor maker **120** creates a new shared configuration object at step **486** and adds it to the shared configuration database at step **488**. At this point the user session is synchronized on the tutorial database. The user session is then synchronized on the shared tutorial object by setting the SC count to one at step **490** and then calling the load concept knowledge base (step **492**), the load problem knowledge base (step **494**) or load pedagogy knowledge base (step **496**) as more fully described in FIG. **43**.

FIG. **43** shows the load knowledge base function **520** performed by the tutor maker **120** that initially queries whether the particular knowledge base (i.e., concept knowledge base, problem knowledge base, pedagogy knowledge base) has been previously loaded at step **498** to synchronize on the tutorial database. FIG. **43** represents the method used to load all three knowledge bases associated with a configuration. If so, the tutor maker **120** retries the shared tutorial object corresponding to the requested knowledge base at step **502**, increments the count for that knowledge base at step **504**, and the shared tutorial object is set in the appropriate slot of the shared configuration **97** at step **506**. More specifically, if the concept knowledge base is being loaded, then the shared configuration object **97** will have its concept knowledge base reference set to point to the shared tutorial object created for the concept knowledge base. In this way, each user session refers to a shared configuration structure, which in turn refers to shared tutorial objects, each of which keeps a count of the current number of users currently using each component of a configuration. Thus, when the count of a shared tutorial object (decremented as each user logs off) reaches zero, that object may be deleted. If the knowledge base has not been previously loaded, it is then loaded as a shared tutorial object at step **508**, which is then added to the corresponding links within the tutorial database at step **510**. For each added shared tutorial object, the increment count is set to one at step **512** and then set in the appropriate slot of the shared configuration **97** at step **506**. As shown in FIG. **43**, part A involves synchronizing on the tutorial database, while part B involves synchronizing on the shared tutorial object.

FIG. **44** describes the delete configuration function **500** used when the last user for a particular configuration logs off in order to delete the configuration from the tutorial database. At step **516**, the tutor maker **120** determines the shared decrement count for the configuration in question and checks whether the count for the configuration is equal to zero at step **518**. If not, the count is decremented by one. If the SC count is zero after the removal of this instance of the configuration, then the parallel processing for each of the concept knowledge base, problem knowledge base and pedagogy knowledge base occurs. For example, a concept knowledge base might be used on other loaded configurations so that while the configuration (i.e., the particular set of concept, problem and pedagogy knowledge bases) count may now be zero, the particular concept knowledge base used for the configuration might not have a count that goes to zero (e.g., if it is shared between at least one other configuration). Thus, for each of the concept knowledge base, the problem knowledge base, and the pedagogy knowledge base, the delete knowledge base function **530** (shown in FIG. **45**) performs the similar decrement analysis as done for the overall configuration prior to deleting them (steps **522**, **524**, and **526**). Finally, because the shared configuration count is zero, the shared configuration is marked as invalid at step **528** and cleaned up.

FIG. **45** shows the delete knowledge base function **530** that is applicable for each of the three knowledge bases. Similarly to the steps in FIG. **44**, for the knowledge base being deleted the decrement count of the shared tutorial object corresponding to the knowledge base is determined at step **532**, and if it is not zero, the count is decremented by one and if it is zero, the knowledge base is marked as invalid at step **536**.

FIG. **46** shows the generation of HTML function **540** to describe the generation or building of HTML generally on the tutor maker **120** side of the operation of the present invention. This can include extracting HTML to generate a page for the user, generating HTML for particular formats, generating features on an HTML page such as toolbars, etc. At step **542**, the tutor maker **120** can either output a header or not, and if so, outputs a general header HTML at step **544** that can include a style sheet. A style sheet is mechanism by which any HTML web page that has been generated has certain styles automatically overlaid onto it. By automatically associating a style sheet will all generated HTML, the present invention can control the look and feel of the pages that are presented to the user. After the style sheet is loaded or not at steps **548** and **548**, a script call can be made at set **550**. A script, for example javascript, is loaded from a link at step **552**. The tutor maker **120** can then go get the HTML from either a configuration file (step **554**) or generated based on a pedagogy generation (step **556**). If the HTML will be extracted from a configuration file, the tutor maker **120** accesses the user object from the user session at step **558**, accesses the configuration from the user object at step **560**, accesses the problem or concept from the configuration **10** and extracts the HTML from the concept at step **562**, and outputs the HTML at step **564**. If HTML is not to be extracted from a configuration, then the tutor maker may have to generate a pedagogy (step **556**). If generating a pedagogy, then the tutor maker **120** can first access a user object from the user session at step **568**, access the configuration from the user object at step **570**, extract the concept(s) and prerequisite(s) from the configuration (and optionally the user history information) at step **572**, and call the pedagogy generator (see FIG. **37**A). The resulting pedagogy is rendered using either the HTML associated with elements in the pedagogy or an "on-click" event handler. An on-click event handler can be created as follows:

```
General HTML Header Command Elements:
    <!DOCTYPE>
    <HEAD>
    <TITLE>
    <BASE>
    <META>
Event Handler Format:
    Click:   <  HTML-ELEMENT-NAME  on Click="event-Function (parameter)"  >
    Mouse:   <          "          on MouseOver=          "              >
             <          "          on MouseOut=           "              >
    etc.
    links HTML ELEMENT TO event-Function in script, and passes
    arguments to that function
Shared Data Objects:
    Current HTML (3.2): use <FORM> element with "hidden" <INPUT>
    elements. Future HTML versions may use <OBJECT> element.
```

In one embodiment, the present invention uses the above-referenced general HTML commands (shown in angled brackets) are used in the header. The event handler format is contained within an angle bracket having some HTML element name (e.g., highlight), followed by "on-click" and the text for the function call in the browser extension **30**. This allows the overriding of the typical response when a user clicks on this particular HTML element. Thus, the tutor maker **120** overrides by providing the specific on-click command. Similarly, specific events can occur for mouse-overs, and other standard HTML events. Thus, some HTML elements allow the overriding of typical responses on certain events (such as, on-click, on mouse-over, and on mouse-out) that are pre-defined for HTML. The shared data objects (e.g., a toolbar) are global variables that can be hidden input elements. One of ordinary skill in the art will appreciate how to create an on-click type event handler. Thus, the results (i.e., the graph) generated can be printed out, for example as hyperlinks. In one embodiment, the hyperlinks are separated into two frames and the normal browser hyperlink is overridden using the above described on-click mechanism. Finally, at step **578**, the tutor maker **120** can create a closer and close the open HTML elements at step **580**. A closer is a commonly used mechanism to end an HTML generation event. As shown in FIG. **46**, tutor maker **120** uses style sheets and scripts to extend the browser in an internet application of the present invention.

FIG. **47** describes the operation of the toolbar HTML generation function **582**. In one embodiment, the present

invention can include a toolbar in each HTML page generated for a user to simplify use of the present invention. The toolbar can be generated by outputting a header with a script and style sheet at step **584**. At step **586**, the tutor maker **120** can include a global form onto each HTML page so that the form is shared among all generated frames. In another embodiment, the global data of a toolbar can be accomplished using the <object>element of HTML (proposed for version 4.0 of HTML). At step **588**, the tutor maker **120** outputs the shared data objects for the state information on the client computer **220** side (i.e., the browser side for an internet application) and finally, outputs the button image that is linked to an event handler at step **590**.

FIG. **48** shows the operation of the event handler that is part of the user interface **130**. The event handler waits for an event at step **594** and upon receipt of the event calls that type of event. FIG. **49** shows eight exemplary events that can be incorporated into the present invention. Step **596** shows a call tutor maker event that can be accomplished using servlet technology from Sun Microsystems. The event handler accesses the required shared data in servlet form at step **598** and submits the form to invoke the servlet over the internet at step **600**. It should be understood that a variety of methods exist to submit data over a network, and the servlet form method described here is simply one method for use with the internet. The method described here will not cache and therefore it is important to use a form-submit or similar methodology for a browser-specific implementation of the present invention over the internet. Other actions include an exit function shown include an exit servlet at step **602**, an update hierarchy at step **603**, a concept link at step **604**, a button state at step **605**, a pop-up window at step **606**, a change display mode at step **607** and an exit at step **608** to exit the event handler by calling a pop-up handler to kill all pop-up windows at step **60-9** and sending a call servlet event with a 'logout' action at step **610**. The update hierarchy event is accomplished by modifying the old image to remove the present location indicator at step **611** and modifying the new image to include the present location indicator at step **612**. The concept link involves extracting the servlet data from a concept link event handler at step **613** and sending a call servlet event containing that extracted data at step **614**. The button state event is initiated by setting the shared data objects to reflect the current button state at step **615** and replacing the button image at step **616**. The pop-up window event simply calls a pop-up handler with the servlet data at step **617** (as shown more fully in FIG. **50**), while the change display mode similarly calls a mode handler with the servlet data at step **618** (as shown more fully in FIG. **50**).

FIG. **49** describes the pop-up handler function **620** including an initial request from the user interface **130** to either terminate the pop-up window (step **624**) or to access a pop-up window (step **626**). If the pop-up window is requested, the user interface **130** can first check to determine if the pop-up window is already present at step **628**, and if so, can re-use the existing pop-up window at step **632**. If not, the pop-up window is generated in its default state at step **630**. Finally, the pop-up window contents can be updated by calling a servlet via the servlet data form in the toolbar frame at step **634**.

FIG. **50** describes the mode changer function **640** that changes the mode of the browser display. At step **642**, an event handler can be called to set the new button states for the new mode. The user interface can determine whether the new mode requires terminating any/all pop-up windows at step **644**, and if so, can call the pop-up handler of FIG. **49** to do so as shown at step **646**. At step **648**, the user interface **130** sets the shared data to reflect the new mode information. The call servlet function is then performed at step **650** to update the browser display. Multiple call servlets can be made if the new display has multiple frames. For example, each of the frames can call the event handler with the appropriate servlet data.

Although the present invention has been described in detail, it should be understood that various changes, substitutions and alterations can be made hereto without departing from the spirit and scope of the invention as described by the appended claims.

What is claimed is:

1. A system for delivering information to a user of a computer having a processor and a memory, comprising:

a configuration database stored on the memory and comprising a plurality of concepts and including a hierarchy that defines the relationships among the plurality of concepts;

a knowledge delivery program executable by the processor to:

create a presentation format for the configuration; and

deliver at least a portion of the plurality of concepts in the configuration to the user according to the presentation format.

2. The system of claim **1**, wherein the knowledge delivery program automatically creates the presentation format for the configuration based on the hierarchy.

3. The system of claim **1**, wherein the presentation format is created in response to a user request and based on a set of inputs from the user.

4. The system of claim **3**, wherein the knowledge delivery program further comprises:

a configuration editor software program executable to:

allow an author to create the concept knowledge base and the problem knowledge base;

allow the author to build the hierarchy as the author inputs the concepts into the concept knowledge base; and

store the configuration in the memory; and

a tutor maker software program executable to:

allow the user to access the configuration;

retrieve concepts and problems within the configuration based on the presentation format; and

send the concepts and problems within the presentation format to the user according to the presentation format;

and wherein each configuration further comprises:

a concept knowledge base containing the plurality of concepts;

a problem knowledge base containing a plurality of problems relating to the concepts in the concept knowledge base; and

a presentation format knowledge base containing at least one presentation format for the concepts in the concept knowledge base.

5. The system of claim **4**, wherein the set of inputs comprises the user's familiarity with the plurality of concepts, a level of detail the user wants, or a format in which the user wants the at least a portion of the plurality of concepts presented.

6. The system of claim **5**, wherein the concepts input by the author include content, wherein the content can comprise descriptive content, referential content, or both, and wherein the hierarchy represents a portion of the referential content of the configuration.

7. The system of claim **4**, wherein the knowledge delivery program further comprises a user interface software program that the user can use to access the tutor maker program.

8. The system of claim 7, wherein the user interface further comprises:

a browser that enables browsing of the network; and

a browser extension, comprising an event handler executable to allow the user to generate an event to be acted upon by the tutor maker program.

9. The system of claim 4, wherein the configuration editor program further comprises:

a concept editor executable to allow the author to add, delete or modify concepts within the concept knowledge base and to create a hierarchy for the concepts in the concept knowledge base, further comprising a concept reader executable to retrieve existing concepts within the concept knowledge base;

a problem editor executable to allow the author to add, delete, or modify problems within the problem knowledge base, further comprising a problem reader to retrieve existing problems within the problem knowledge base;

a presentation format generator executable to automatically generate a presentation format for the configuration; and

a presentation format editor executable to allow the author to manually create a presentation format or to modify an automatically created presentation format within the presentation format knowledge base, further comprising a presentation format reader executable to retrieve an existing presentation format.

10. The system of claim 9, wherein the concepts within the concept knowledge base are compatible with or convertible to a format compatible with delivery of information from a global computer network to a general purpose browser, and wherein the concept reader is further executable to create a pointer for each concept that will point to all content associated with each concept.

11. The system of claim 4, wherein the tutor maker program further comprises:

an action handler program executable to receive a request relating to a requested configuration from the user and process the request;

a tutorial manager program executable to:

determine whether the content of the requested configuration has previously been loaded, and if not, load the requested configuration; and

determine whether a user session has been established, and if not, establish a user session;

a tutorial database containing each loaded configuration;

a user session, executable to:

establish a thread for each user to facilitate synchronization among multiple users;

process the request by accessing the loaded requested configuration;

generate a response; and

an a format compatible with delivery of information from a global computer network to a general purpose browser generator executable to:

receive the response from the user session;

place the response in a format compatible with delivery of information from a global computer network to a general purpose browser format; and

transmit the a format compatible with delivery of information from a global computer network to a general purpose browser response back to the user.

12. The system of claim 11, wherein the action handler processes the request by forwarding the request to the user session.

13. The system of claim 11, wherein the tutorial manager is further executable to track a set of referential content associated with each concept in the concept knowledge base, each problem in the problem knowledge base and each presentation format in the presentation format knowledge base to ensure that only one instance of each knowledge base is loaded at any one time.

14. The system of claim 11, wherein the tutorial manager program further comprises:

a concept reader executable to retrieve existing concepts within the concept knowledge base;

a problem reader to retrieve existing problems within the problem knowledge base; and

a presentation format reader executable to retrieve an existing presentation format.

15. The system of claim 11, wherein the tutorial database is a collection of pointers that point to a collection of a format compatible with delivery of information from a global computer network to a general purpose browser pages that make up the loaded configuration.

16. The system of claim 11, wherein the user session is further executable to build a user model for each user that contains at least a historical data base of the user's interactions with the tutor maker program.

17. The system of claim 11, wherein the action handler processes the request by either forwarding the request to the tutorial manager if a user session has not previously been established, or forwarding the request to the user session if a user session has previously been established.

18. The system of claim 11, wherein the tutor maker further comprises a presentation format generator executable to generate a user-defined presentation format for the loaded configuration.

19. The system of claim 8, wherein the network is the internet and the browser is an internet browser, and further wherein the event handler further comprises:

a pop-up handler executable to receive an input from the event handler and, if a pop-up up window is associated with the input, creates the pop-up window for viewing by the user;

a mode changer executable to receive an input from the event handler and, if a mode change is associated with the input, creates the mode change for viewing by the user; and

an action sender executable to send a request based on the input from the event handler to the tutor maker program.

20. The system of claim 1, wherein the concepts are delivered to the user in a tutorial format.

21. The system of claim 1, further comprising a plurality of configurations, wherein any number of the plurality of configurations can be accessed by any number of users simultaneously.

22. The system of claim 1, wherein the knowledge delivery program creates the presentation format automatically by:

creating a graph representing the concept knowledge base based on the hierarchy input by the author; and

searching the graph using a graph searching algorithm to place concepts within the presentation format based on the order found by the graph searching algorithm.

23. The system of claim 22, wherein the knowledge delivery program is further executable to allow the author to select a goal concept and at least one prerequisite concept, and wherein the graph searching algorithm uses the goal concept as a starting point and the prerequisite concepts as

an ending point and collects a subgraph of the concept knowledge base graph, the subgraph defining the presentation format so that both a set of relevant concepts and an order to display the relevant concepts is generated automatically.

24. A system for delivering information to a user of a computer over a network, comprising:

a server computer, comprising:
a server processor; and
a server memory;

a client computer connected to the server computer via the network, comprising:
a client processor; and
a client memory;

a network computer connected to the server computer via a server computer-network computer network, comprising:
a network processor; and
a network memory;

a configuration editor program stored on the network computer memory and executable by the network computer processor to allow an author to:
create a configuration database comprising a plurality of concepts; and
build a configuration hierarchy defining the relationships among the plurality of concepts;

a presentation format generator program stored on either the server computer memory or the network computer memory and executable to:
automatically create a presentation format for the configuration based on the configuration hierarchy; and

a tutor maker program stored on the server computer memory and executable by the server processor based on requests from the user to:
deliver at least a portion of the plurality of concepts in the configuration to the user according to the configuration presentation format.

25. The system of claim **24**, further comprising a user interface program stored on the client computer memory and executable by the client processor to allow a user to send requests to and receive responses from the server computer via the network, and wherein a user can sent an input that initiates the automatic generation of the presentation format.

26. The system of claim **25**, wherein the network is the internet and the user interface program further comprises:

an internet browser that enables browsing of the internet; and

a browser extension, comprising an event handler executable to allow the user to generate an event to be acted upon by the tutor maker program.

27. The system of claim **26**, wherein the event handler further comprises:

a pop-up handler executable to receive an input from the event handler and, if a pop-up up window is associated with the input, create the pop-up window for viewing by the user;

a mode changer executable to receive an input from the event handler and, if a mode change is associated with the input, create the mode change for viewing by the user; and

an action sender executable to send a request based on the input from the event handler to the tutor maker program.

28. The system of claim **24**, wherein each configuration database further comprises:

a concept knowledge base containing the plurality of concepts;

a problem knowledge base containing a plurality of problems relating to the concepts in the concept knowledge base; and

a presentation format knowledge base containing at least one presentation format for the concepts in the concept knowledge base.

29. The system of claim **24**, wherein the configuration editor software program is further executable to:

allow an author to create the configuration by inputting the concepts into the concept knowledge base and inputting the problems into the problem knowledge base;

allow the author to build the hierarchy as the author inputs the concepts into the concept knowledge base; and

store the configuration in the server memory.

30. The system of claim **24**, wherein the concepts input by the author include content, wherein the content can comprise descriptive content, referential content, or both.

31. The system of claim **24**, wherein the configuration editor program further comprises:

a concept editor executable to allow the author to add, delete or modify concepts within the concept knowledge base and to create a hierarchy for the concepts in the concept knowledge base, further comprising a concept reader executable to retrieve existing concepts within the concept knowledge base for deletion or modification;

a problem editor executable to allow the author to add, delete, or modify problems within the problem knowledge base, further comprising a problem reader to retrieve existing problems within the problem knowledge base for deletion or modification; and

a presentation format editor executable to allow the author to manually create a presentation format or to modify an automatically created presentation format within the presentation format knowledge base, further comprising a presentation format reader executable to retrieve an existing presentation format for modification.

32. The system of claim **31**, wherein the concepts within the concept knowledge base are compatible with or convertible to a format compatible with delivery of information from a global computer network to a general purpose browser, and wherein the concept reader is further executable to create a pointer for each concept that will point to all content associated with each concept.

33. The system of claim **25**, wherein the tutor maker program is further executable to:

receive requests from the user over the internet from the user interface;

retrieve concepts within the configuration based on the presentation format; and

send the concepts to the user according to the presentation format.

34. The system of claim **25**, wherein the tutor maker program further comprises:

an action handler program executable to receive a request relating to a requested configuration from the user and process the request;

a tutorial manager program executable to:
determine whether the content of the requested configuration has previously been loaded, and if not, load the requested configuration; and
determine whether a user session has been established, and if not, establish a user session;

a tutorial database containing each loaded configuration;

a user session, executable to:

establish a thread for each user to facilitate synchronization among multiple users; and

process the request by accessing the loaded requested configuration and generate a response; and

an a format compatible with delivery of information from a global computer network to a general purpose browser generator executable to:

receive the response from the user session;

place the response in a format compatible with delivery of information from a global computer network to a general purpose browser format; and

transmit the response back to the user.

35. The system of claim **34**, wherein the tutorial manager is further executable to track a set of referential content for each particular concept knowledge base, problem knowledge base and presentation format knowledge base to ensure that only one instance of each knowledge base is loaded at any one time.

36. The system of claim **34**, wherein the tutorial manager program further comprises:

a concept reader executable to retrieve existing concepts within the concept knowledge base;

a problem reader to retrieve existing problems within the problem knowledge base; and

a presentation format reader executable to retrieve an existing presentation format.

37. The system of claim **34**, wherein the tutorial database is a collection of pointers that point to a collection of a format compatible with delivery of information from a global computer network to a general purpose browser pages that make up the loaded configuration.

38. The system of claim **34**, wherein the action handler processes the request by either forwarding the request to the tutorial manager if a user session has not previously been established, or forwarding the request to the user session if a user session has previously been established.

39. The system of claim **34**, wherein the tutor maker program further comprises a presentation format generator executable to generate a user-defined presentation format for the loaded configuration.

40. The system of claim **24**, wherein the presentation format generator program is further executable to search a graph representing the concept knowledge base that is based on the hierarchy input by the author using a graph searching algorithm to place concepts within the presentation format based on the order found by the graph searching algorithm.

41. The system of claim **40**, wherein the configuration editor program is further executable to allow the author to select a goal concept at least one prerequisite concept, and wherein the presentation format generator program is further executable to initiate the graph searching algorithm using the goal concept as a starting point and the prerequisite concepts as an ending point to collect a subgraph of the concept knowledge base that defines the presentation format.

42. The system of claim **24**, wherein the server memory further comprises file memory and random access memory, and wherein the tutor maker program is stored in file memory and the configuration is stored in random access memory.

43. The system of claim **26**, wherein the browser extension is further executable to:

send a request to the tutor maker over the internet; and

retrieve a response from the tutor maker over the internet, wherein all interactions between the browser extension and the tutor maker are sent through a single URL.

44. The system of claim **43**, wherein the tutor maker program can determine if the user has sent a request from a different URL than the user had originally set up for the user session and will respond to the user with a query as to whether the user wishes to log off at the original URL location, and if so, logs the user off at the original location.

45. A system comprising a knowledge delivery computer program stored in computer-readable form on a tangible storage medium for delivering concepts from a configuration data base, the knowledge delivery computer program executable by a processor to:

build the configuration data base to include a plurality of concepts;

create a configuration hierarchy to define a relationship between each of the plurality of concepts;

automatically generate a presentation format for the configuration based on the configuration hierarchy; and

deliver at least a portion of the plurality of concepts to a user according to the presentation format.

46. The system of claim **45**, wherein the knowledge delivery program further comprises:

a configuration editor software program executable to:

allow an author to create the configuration by inputting the concepts into the concept knowledge base; and

allow the author to build the hierarchy as the author inputs the concepts into the concept knowledge base;

store the configuration in the memory; and

a tutor maker software program executable to:

allow the user to access the configuration;

retrieve concepts within the configuration based on the presentation format; and

send the concepts within the presentation format to the user according to the presentation format.

47. The system of claim **45**, wherein the concepts input by the author include content, wherein the content can comprise descriptive content, referential content, or both.

48. The system of claim **45**, wherein the knowledge delivery program further comprises a user interface software program that the user can use to access the tutor maker program, wherein the user may initiate automatic generation of the presentation format by sending an input to the tutor maker program.

49. The system of claim **48**, wherein the user interface further comprises:

a browser that enables browsing of the network; and

a browser extension, comprising an event handler executable to allow the user to generate an event to be acted upon by the tutor maker program, wherein the event handler further comprises:

a pop-up handler executable to receive an input from the event handler and, if a pop-up up window is associated with the input, create the pop-up window for viewing by the user;

a mode changer executable to receive an input from the event handler and, if a mode change is associated with the input, create the mode change for viewing by the user; and

an action sender executable to send a request based on the input from the event handler to the tutor maker.

50. The system of claim **46**, wherein the configuration editor program further comprises:

a concept editor executable to allow the author to add, delete or modify concepts within the concept knowledge base and to create a hierarchy for the concepts in the concept knowledge base, further comprising a concept reader executable to retrieve existing concepts within the concept knowledge base for deletion or modification;

a presentation format generator executable to automatically generate a presentation format for the configuration; and

a presentation format editor executable to allow the author to manually create a presentation format or to modify an automatically created presentation format within the presentation format knowledge base, further comprising a presentation format reader executable to retrieve an existing presentation format for modification.

51. The system of claim **46**, wherein the tutor maker program further comprises:

an action handler program executable to receive a request relating to a requested configuration from the user and process the request;

a tutorial manager program executable to:

determine whether the content of the requested configuration has previously been loaded, and if not, load the requested configuration; and

determine whether a user session has been established, and if not, establish a user session and wherein the tutorial manager further comprises a concept reader executable to retrieve existing concepts within the concept knowledge base;

a tutorial database containing each loaded configuration;

a user session, executable to:

establish a thread for each user to facilitate synchronization among multiple users; and

process the request from the loaded requested configuration and generate a response; and

an a format compatible with delivery of information from a global computer network to a general purpose browser generator executable to:

receive the response from the user session;

place the response in a format compatible with delivery of information from a global computer network to a general purpose browser format; and

transmit the response back to the user.

52. The system of claim **46**, wherein the knowledge delivery program creates the presentation format automatically by:

creating a graph representing the concept knowledge base that is based on the hierarchy input by the author; and

searching the graph using a graph searching algorithm to place concepts within the presentation format based on the order found by the graph searching algorithm.

53. The system of claim **52**, wherein the knowledge delivery program allows the author to select a goal concept and at least one prerequisite concept, and wherein the graph searching algorithm uses the goal concept as a starting point and the prerequisite concepts as an ending point and collects a subgraph of the concept knowledge base graph that defines the presentation format.

54. A computer program product comprising:

a computer usable medium; and

a computer readable program embodied in said medium, said computer readable program operable to deliver concepts to the user, said computer readable program executable to:

build a configuration data base to include a plurality of concepts;

create a configuration hierarchy to define a relationship between each of the plurality of concepts;

automatically generate a presentation format for the configuration based on the configuration hierarchy; and

deliver at least a portion of the plurality of concepts to a user according to the presentation format to inform the user.

55. The system of claim **54**, wherein each configuration further comprises:

a concept knowledge base containing the plurality of concepts;

a problem knowledge base containing a plurality of problems relating to the concepts in the concept knowledge base; and

a presentation format knowledge base containing at least one presentation format for the concepts in the concept knowledge base.

56. The system of claim **55**, wherein the computer program product further comprises:

a configuration editor software program executable to:

allow an author to create the configuration by inputting the concepts into the concept knowledge base and inputting the problems into the problem knowledge base;

allow the author to define the relationships among the concepts to build the hierarchy as the author inputs the concepts into the concept knowledge base;

store the configuration in the memory;

a tutor maker software program executable to:

allow the user to access the configuration and to sent an input to the tutor maker program to initiate automatic generation of the presentation format;

retrieve concepts and problems within the configuration based on the presentation format; and

send the concepts and problems within the presentation format to the user according to the presentation format.

57. The system of claim **56**, wherein the computer program product further comprises a user interface software program that the user can use to access the tutor maker program, wherein the user interface further comprises:

a browser that enables browsing of the network; and

a browser extension, comprising an event handler executable to allow the user to generate an event to be acted upon by the tutor maker program.

58. The system of claim **57**, wherein the network is the internet and the browser is an internet browser, and further wherein the event handler further comprises:

a pop-up handler executable to receive an input from the event handler and, if a pop-up up window is associated with the input, create the pop-up window for viewing by the user;

a mode changer executable to receive an input from the event handler and, if a mode change is associated with the input, create the mode change for viewing by the user; and

an action sender executable to send a request based on the input from the event handler to the tutor maker.

59. The system of claim **56**, wherein the configuration editor program further comprises:

a concept editor executable to allow the author to add, delete or modify concepts within the concept knowledge base and to create a hierarchy for the concepts in the concept knowledge base, further comprising a concept reader executable to retrieve existing concepts within the concept knowledge base;

a problem editor executable to allow the author to add, delete, or modify problems within the problem knowledge base, further comprising a problem reader to retrieve existing problems within the problem knowledge base;

a presentation format generator executable to automatically generate a presentation format for the configuration; and

a presentation format editor executable to allow the author to manually create a presentation format or to modify an automatically created presentation format within the presentation format knowledge base, further comprising a presentation format reader executable to retrieve an existing presentation format for modification.

60. The system of claim **59**, wherein the concepts within the concept knowledge base are compatible with or convertible to a format compatible with delivery of information from a global computer network to a general purpose browser, and wherein the concept reader is further executable to create a pointer for each concept that will point to all content associated with that concept.

61. The system of claim **56**, wherein the tutor maker program further comprises:

an action handler program executable to receive a request relating to a requested configuration from the user and process the request;

a tutorial manager program executable to:

determine whether the content of the requested configuration has previously been loaded, and if not, load the requested configuration; and

determine whether a user session has been established, and if not, establish a user session;

a tutorial database containing each loaded configuration;

a user session, executable to:

establish a thread for each user to facilitate synchronization among multiple users; and

process the request from the loaded requested configuration and generate a response;

an a format compatible with delivery of information from a global computer network to a general purpose browser generator executable to:

receive the response from the user session;

place the response in a format compatible with delivery of information from a global computer network to a general purpose browser format; and

transmit the response back to the user.

62. The system of claim **61**, wherein the tutorial manager program further comprises:

a concept reader executable to retrieve existing concepts within the concept knowledge base;

a problem reader to retrieve existing problems within the problem knowledge base; and

a presentation format reader executable to retrieve an existing presentation format.

63. The system of claim **61**, wherein the tutorial database is a collection of pointers that point to a collection of a format compatible with delivery of information from a global computer network to a general purpose browser pages that make up the loaded configuration.

64. The system of claim **61**, wherein the action handler processes the request by either forwarding the request to the tutorial manager if a user session has not previously been established, or forwarding the request to the user session if a user session has previously been established.

65. The system of claim **61**, wherein the tutor maker further comprises a presentation format generator executable to generate a user-defined presentation format for the loaded configuration.

66. The system of claim **54**, wherein the computer program creates the presentation format automatically by:

creating a graph representing the concept knowledge base that is based on the hierarchy input by the author; and

searching the graph using a graph searching algorithm to place concepts within the presentation format based on the order found by the graph searching algorithm.

67. A method for delivering data to a user over a network, comprising:

building a configuration data base to include a plurality of concepts;

creating a configuration hierarchy to define a relationship between each concept in the plurality of concepts;

automatically generating a presentation format for the configuration based on the configuration hierarchy; and

delivering at least a portion of the plurality of concepts to the user according to the presentation format.

68. The method of claim **67**, wherein creating a configuration further comprises:

creating a concept knowledge base containing the plurality of concepts;

creating a problem knowledge base containing a plurality of problems relating to the concepts in the concept knowledge base; and

creating a presentation format knowledge base containing at least one presentation format for the concepts in the concept knowledge base.

69. The method of claim **68**, further comprising:

creating the configuration by inputting the concepts into the concept knowledge base and inputting the problems into the problem knowledge base;

defining the relationships among the concepts to build the hierarchy as the author inputs the concepts into the concept knowledge base;

storing the configuration in the memory;

accessing the configuration;

retrieving concepts and problems within the configuration based on the presentation format; and

sending the concepts and problems within the presentation format to the user according to the presentation format.

70. The method of claim **69**, further comprising:

generating a request to receive content from the configuration;

receiving the request relating to a requested configuration;

determining whether the content of the requested configuration has previously been loaded, and if not, loading the requested configuration; and

determining whether a user session has been established, and if not, establishing a user session;

processing the request from the loaded requested configuration;

generating a response; and

transmitting the response.

71. The method of claim **70**, further comprising tracking a set of referential content for each particular concept knowledge base, problem knowledge base and presentation format knowledge base to ensure that only one instance of each knowledge base is loaded at any one time.

72. The method of claim **71**, further comprising:

receiving the response from the user session; and

placing the response in a format compatible with delivery of information from a global computer network to a general purpose browser format.

73. The method of claim **67**, wherein automatically generating the presentation format further comprises:

creating a graph representing the concept knowledge base based on the hierarchy input by the author;

searching the graph using a graph searching algorithm; and

placing the concepts within the presentation format based on the order found by the graph searching algorithm.

74. The method claim **73**, further comprising:

selecting a goal concept and at least one prerequisite concept;

starting the search of the graph at the goal concept;

ending the search of the graph at the at least one prerequisite concept; and

generating a presentation format including a set of relevant concepts and an order of presentation for the relevant concepts based on the search.

75. A method for delivering data created by an author at a network computer connected to a server computer to a user at a user computer from the server computer over a network, the method performed by a computer program stored on a tangible medium, said computer program comprising a configuration editor program, a tutor maker program and a user interface program, the method comprising:

executing the configuration editor to:

allow an author to build a configuration data base that includes a plurality of concepts;

create a configuration hierarchy to define a relationship between each of the plurality of concepts; and

automatically generate a presentation format for the configuration based on the configuration hierarchy, wherein the presentation format comprises a framework for presenting at least a portion of the concepts and an order in which the at least a portion of the concepts will be presented;

executing the user interface to:

allow the user to access the tutor maker program and request delivery of concepts from the configuration; and

execute the tutor maker program to deliver at least a portion of the plurality of concepts to the user according to the presentation format.

76. A system for delivering information to a user of a computer having a processor and a memory, comprising:

a configuration database stored on the memory and comprising a plurality of concepts and including a taxonomy that defines the relationships between the plurality of concepts;

a knowledge delivery program executable by the processor to:

create a pedagogy for the configuration; and

deliver a least a portion of the plurality of concepts in the configuration to the user according to the pedagogy.

77. The system of claim **76**, wherein the knowledge delivery program automatically creates the pedagogy for the configuration based on the taxonomy.

78. The system of claim **76**, wherein the pedagogy is created in response to a user request and based on a set of inputs from the user.

79. The system of claim **78**, wherein the knowledge delivery program further comprises:

a configuration editor software program executable to:

allow an author to create the concept knowledge base and the problem knowledge base;

allow the author to build the hierarchy as the author inputs the concepts into the concept knowledge base; and

store the configuration in the memory; and

a tutor maker software program executable to:

allow the user to access the configuration;

retrieve concepts and problems within the configuration based on the pedagogy; and

send the concepts and problems within the pedagogy to the user according to the pedagogy;

and wherein each configuration further comprises:

a concept knowledge base containing the plurality of concepts;

a problem knowledge base containing a plurality of problems relating to the concepts in the concept knowledge base; and

a pedagogy knowledge base containing at least one pedagogy for the concepts in the concept knowledge base.

80. The system of claim **78**, wherein the set of inputs comprises the user's familiarity with the plurality of concepts, a level of detail the user wants, or a format in which the user wants the at least a portion of the plurality of concepts presented.

* * * * *

Appendix C: Related Proceedings Appendix

As stated on page 3 of this Appeal Brief, to the knowledge of Appellants' counsel, there are no known appeals, interferences, or judicial proceedings that will directly affect or be directly affected by or have a bearing on the Board's decision regarding this Appeal.